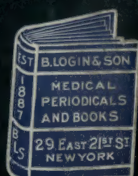
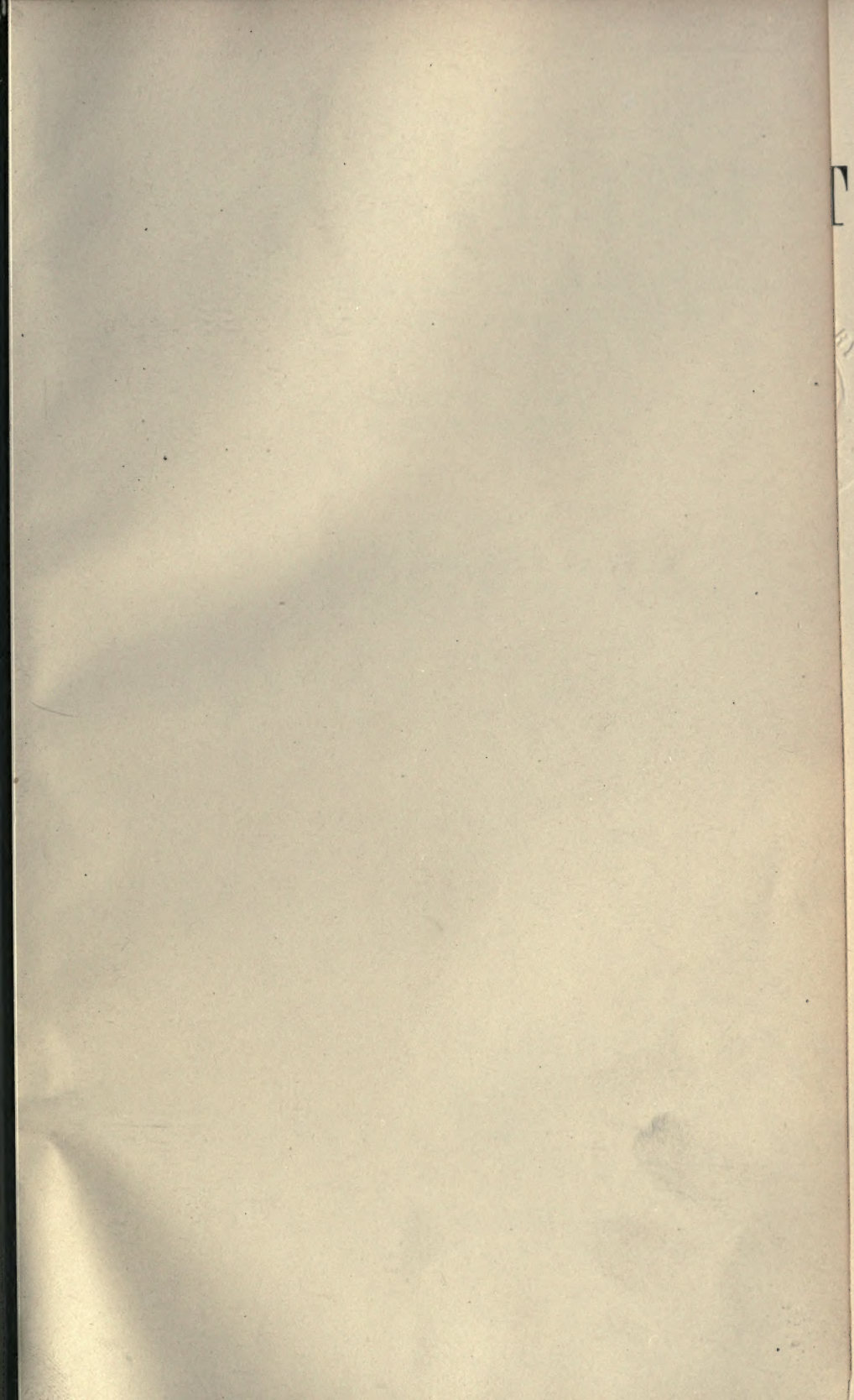


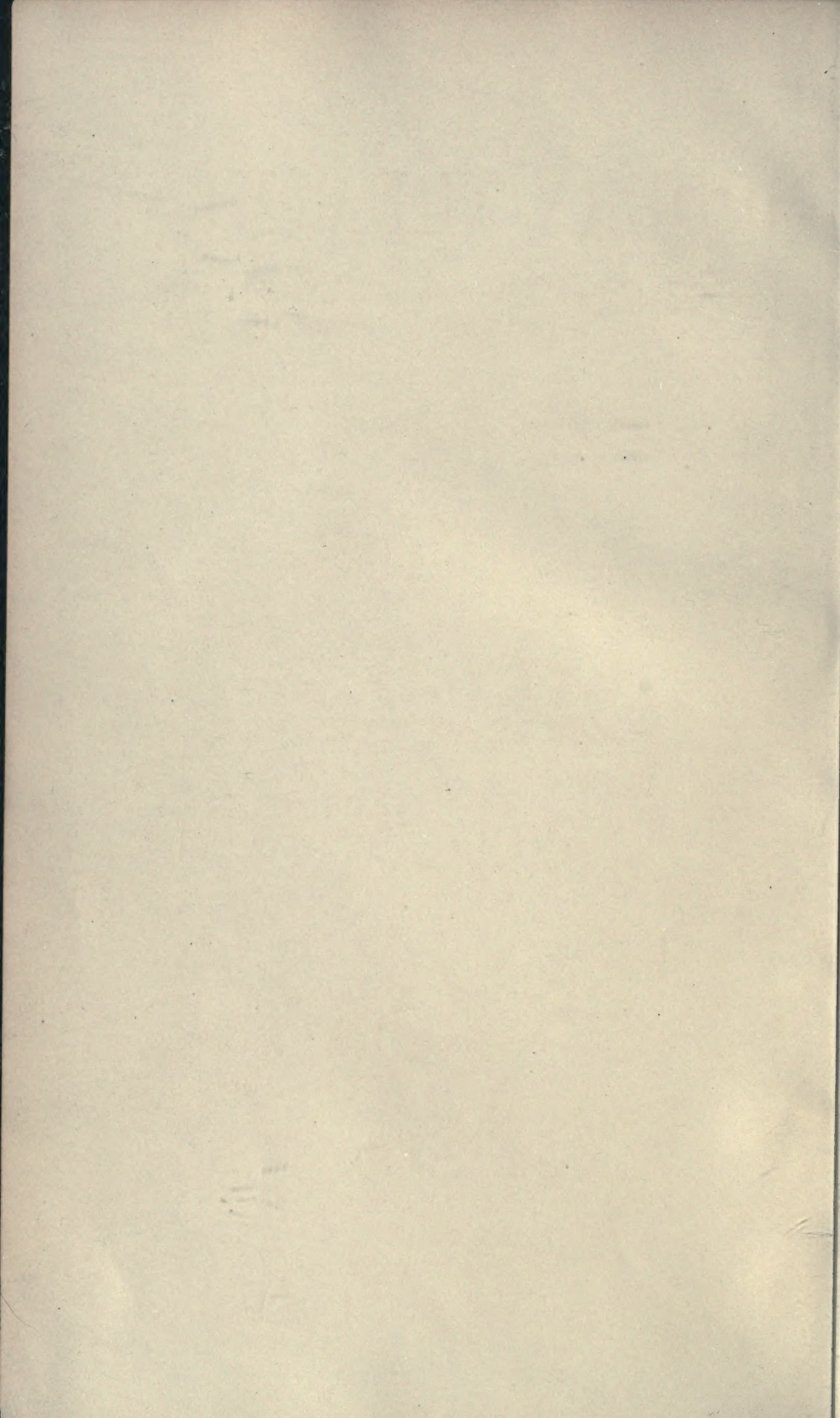


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MODERN TREATMENT

THE MANAGEMENT OF DISEASE WITH MEDICINAL
AND NON-MEDICINAL REMEDIES

IN CONTRIBUTIONS BY AMERICAN AND
FOREIGN AUTHORITIES

EDITED BY

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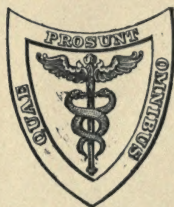
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IN TWO VOLUMES

VOLUME II

ILLUSTRATED



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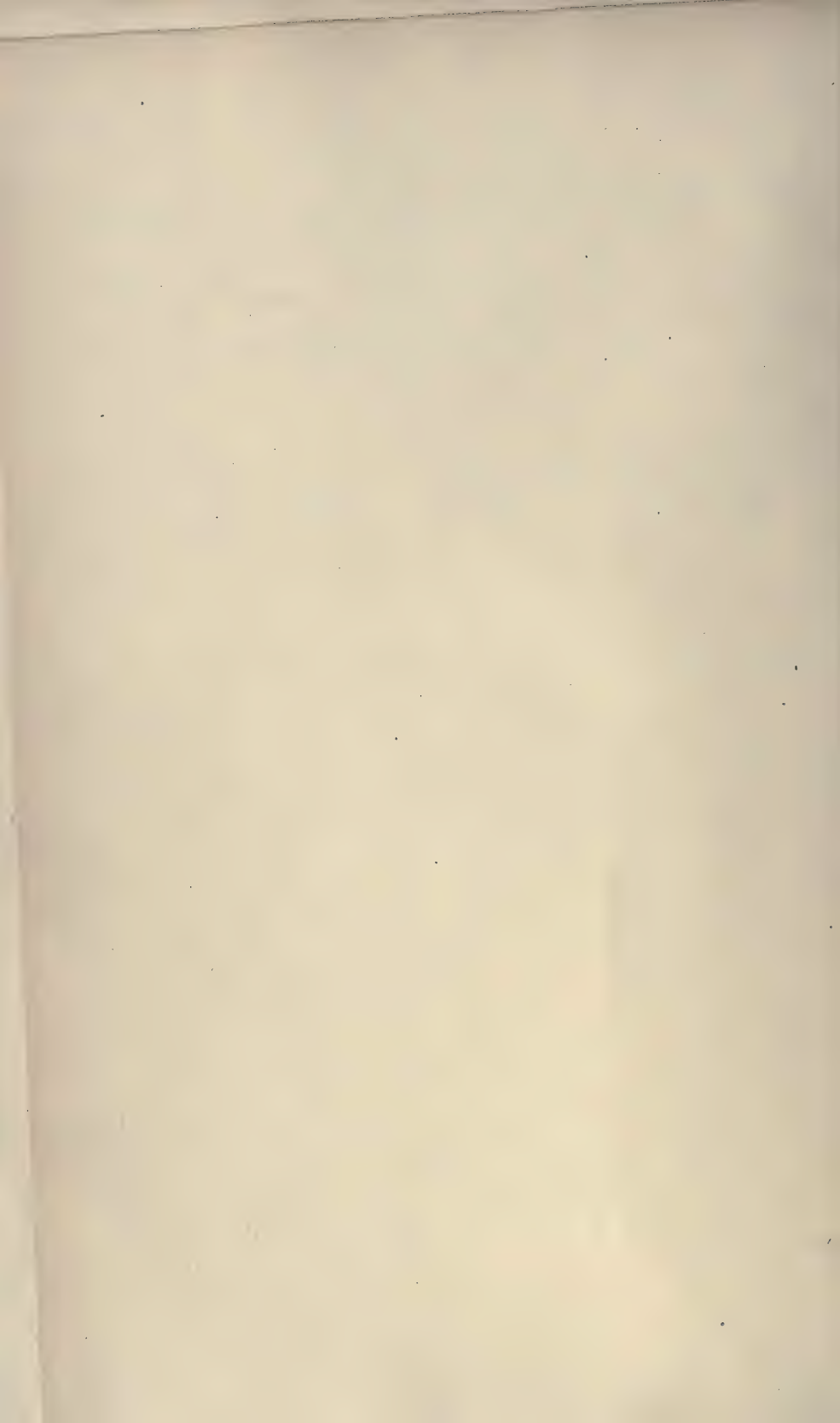
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PART I

THE TREATMENT OF DISEASES DUE TO PARASITIC INFECTION

MALARIAL INFECTIONS. TRYPANOSOMIASIS AND KALA-AZAR. UNCINARIASIS AND HELMINTHIASIS

By CHARLES F. CRAIG, M.D.

MALARIAL INFECTIONS.

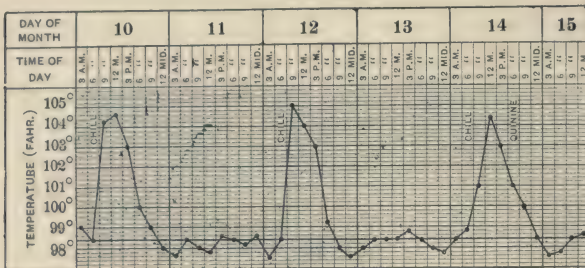
By malarial infections we understand a group of specific fevers due to the invasion of the red blood corpuscles of man by closely related animal parasites belonging to the protozoa. Clinically, these infections are characterized by periodicity in the temperature curve, by their yielding to quinine, and by the fact that they are all transmitted by mosquitoes belonging to the anophelinæ.

In the treatment of these infections, medicine possesses one of its few true specifics; but although this is so, there is perhaps no drug so much misused as quinine, the specific for these fevers. In order that this drug may be properly used it is necessary that the clinician have a true conception of what malarial infections really are, and of how the drug influences the parasites concerned in the production of these most common and important febrile diseases. It will thus be necessary to consider briefly the parasites which cause the various forms of malarial infection and the effect upon these organisms of the specific, quinine.

Etiology.—The parasites causing the various types of malarial infection in man belong to the protozoa, class *sporozoa*, order *hæmosporidia*, and genus *Plasmodium*. The genus contains the following species: *Plasmodium vivax*, the cause of tertian malarial fever; *Plasmodium malarie*, the cause of quartan malaria; *Plasmodium falciparum*, the cause of tertian estivo-autumnal malarial fever; and *Plasmodium falciparum quotidianum*, the cause of quotidian estivo-autumnal malaria. The latter species is not recognized by all authorities, but from an experience of many years, covering thousands of cases of these infections, I am convinced that the quotidian species should be recognized. The type

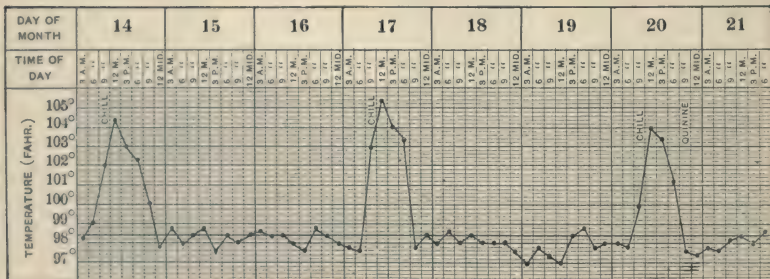
of temperature curve produced by the four species when the infections are uncomplicated and uninfluenced by quinine are well illustrated by the charts given (Figs. 1, 2, 3, and 4), and the type of infection present is of the greatest importance as regards treatment. It will not be necessary here to enter into a detailed description of the morphology, or life cycle, of the species of malarial plasmodia, but a few general remarks are necessary in order to understand the action of quinine upon the parasites and to intelligently use this drug

FIG. 1



Temperature chart of tertian malarial fever.

FIG. 2



Temperature chart of quartan malarial fever.

The malarial plasmodia are essentially parasites of the red blood corpuscles; these they destroy by invading and growing within them, finally sporulating, the spores being liberated by the breaking down of the corpuscles in which they have undergone development. Golgi was the first to demonstrate that the clinical symptoms of a malarial paroxysm *i. e.*, chill, fever, and sweating, were coincident with the sporulation of the parasites, and that tertian and quartan fevers were produced by the sporulation of parasites at the end of twenty-four and forty-eight hours, respectively. The tertian type of estivo-autumnal fever is produced by the sporulation of *Plasmodium falciparum*, which occurs every

PLATE I

FIG. 1

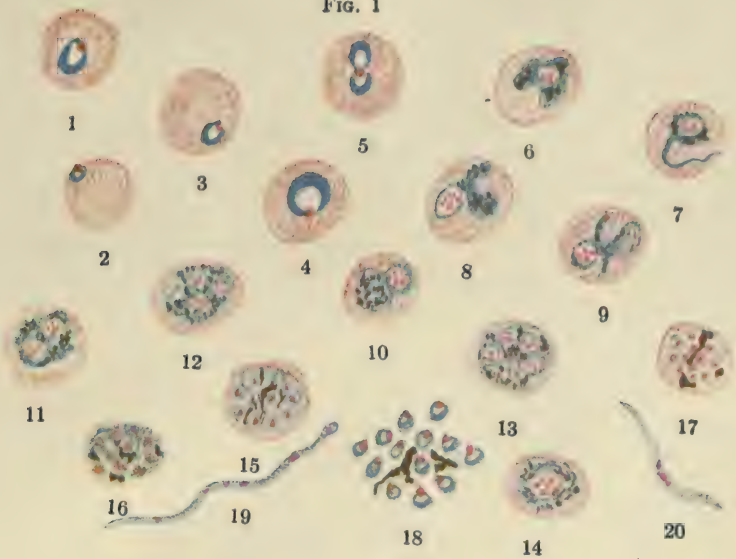
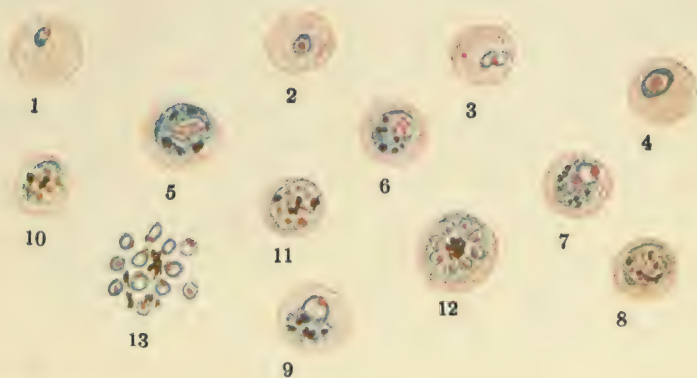


FIG. 2



CHARLES F. CRAIG, DEL.

Fig. 1.—Tertian Malarial Plasmodium. Stained by Oliver's Modification of Wright's Stain.

1 to 4. Ring forms of tertian parasite.

5. Ring form. (Conjugation form of Ewing.)

6 to 10. Pigmented organisms.

11 to 14. Nearly full-grown forms, showing diffusion of the chromatin.

15 to 17. Segmenting forms within red corpuscle.

18. Segmenting forms after destruction of red corpuscle.

19. Microgamete.

20. Sporozoite.

Fig. 2.—Quartan Malarial Plasmodium. Stained by Oliver's Modification of Wright's Stain.

1 to 4. Ring forms of quartan parasite.

5, 6, 7, 8, 9. Pigmented parasites.

10 to 12. Segmenting forms of quartan parasite.

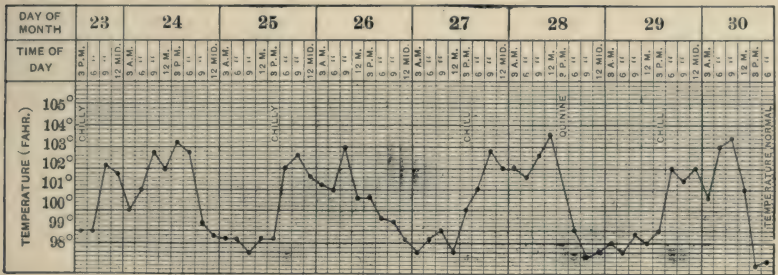
13. Segmenting stage after destruction of red corpuscle.

NOTE.—Chromatin of nucleus stained red; protoplasm stained blue; vesicular portion of nucleus unstained.

forty-eight hours, while the quotidian type of estivo-autumnal malaria is produced by the sporulation of *Plasmodium falciparum quotidianum*, which occurs every twenty-four hours.

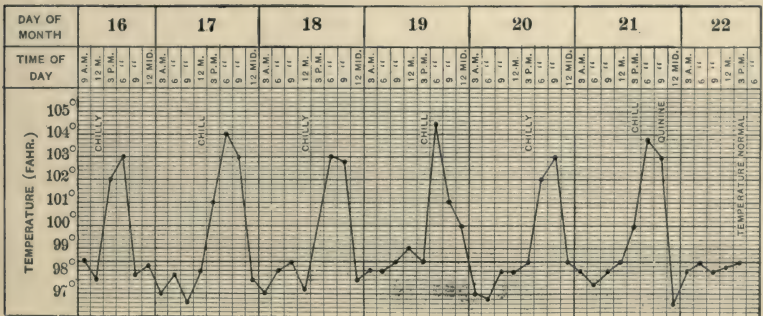
Owing to the researches and discoveries of Ross, Grassi, Marchiafava, Celli and others, we now know that the malarial plasmodia possess two distinct life cycles, one within *man* and one within the *mosquito*. The life cycle completed within *man*, who is the *intermediate* host of these parasites, is known as the *endogenous* or *asexual* cycle, the process of growth

FIG. 3



Temperature chart of tertian estivo-autumnal malarial fever.

FIG. 4



Temperature chart of quotidian estivo-autumnal malarial fever.

and sporulation of the parasites being known as *schizogony*; while the cycle completed within the *mosquito*, or *definitive* host, is called the *exogenous* or *sexual* cycle, the process of development of the plasmodia within the insect being known as *sporogony*. The forms of the plasmodia which undergo development within man are called the *schizont* and *merozoite*, the former term being applied to the parasites from their development within the red blood corpuscle to the time of sporulation; while the latter term is applied to the liberated spore. These forms occur only

in the blood of man, and cannot develop outside of the human body. Developing along with the forms concerned in the human life cycle there are other forms which are destined to undergo development within the mosquito when removed from man by this insect. These forms are known as *gametes*, and are sexually differentiated, the male gamete being called the *microgametocyte*; the female, the *macrogametocyte*. According to Schaudinn, the latter, if not removed from the blood of man by the mosquito, may undergo parthenogenesis, thus producing relapses of the infection, but this is not yet definitely proved. Certain forms of the plasmodia occur which appear to conjugate within the red corpuscles, and it is these forms which I believe to be the cause of relapses in malarial fever.

The forms which are destined to develop within the mosquito, or the *gametes*, are first developed within the red blood corpuscles of man, being, in all probability, derived from certain of the spores, or *merozoites*, formed during the human life cycle. Unlike the *schizonts*, they do not sporulate, but after attaining their full growth within the red corpuscle they are liberated and undergo no further development unless they reach the middle intestine of the mosquito. At this stage of their development they are known collectively as *gametes*, but are sexually distinct, as has been mentioned. The *gametes* of the estivo-autumnal species are crescentic in shape and are commonly called "crescents," while the *gametes* of the tertian and quartan plasmodia are spherical in shape.

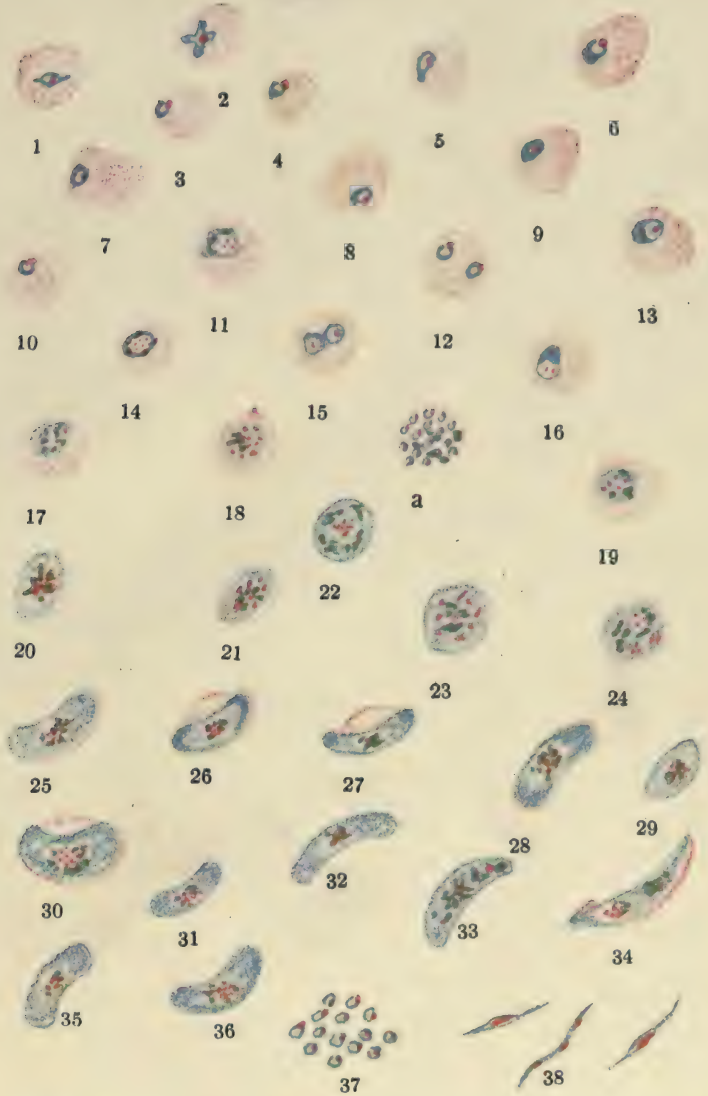
The sexual cycle of development occurs within the intestine of the mosquito, and is initiated by the liberation of delicate flagella from the male, or *microgametocyte*, which are called *microgametes*, while nuclear changes occur in the female gamete, or *macrogametocyte*, after the completion of which it is known as the *macrogamete*. The *macrogamete* is eventually fertilized by the *microgamete*, which enters and becomes absorbed in the former, the resulting organism being called the *ookinete*. The *ookinete* is motile and penetrates the wall of the middle intestine, in which it becomes encysted, forming the *oocyst*. Within the *oocyst* there are developed numerous refractive bodies known as *sporoblasts*, and these eventually produce multitudes of delicate filaments which are called the *sporozoites*. When these have been formed the *oocyst* ruptures and the *sporozoites* make their way to the salivary glands of the mosquito, eventually reaching man, when the insect bites. The cycle of development within the mosquito is completed in from ten to fourteen days.

Having thus briefly reviewed the most important points concerning the plasmodia of malaria, the question of treatment, which depends entirely upon the effect of remedial measures upon these parasites, can be intelligently discussed.

The treatment of malarial infections may be divided into remedial and prophylactic. It is most fortunate that we possess in quinine, and by quinine is meant all of the derivatives of cinchona bark, a drug which is not only a specific from a remedial standpoint, but one which is capable of preventing malarial infection, if properly used.

The history of the discovery of cinchona bark is of interest to every

PLATE II



CHARLES F. CRAIG, DEL.

Tertian Estivo-autumnal Malarial Plasmodium. Oliver's Modification of Wright's Stain.

- | | |
|---|---|
| 1, 3, 4, 5, 6, 7, 8, 9, 10, and 15. Ring forms of tertian estivo-autumnal plasmodium. | 22. Macrogamete. |
| 2. Intracellular form. | 25 to 36. Crescentic forms of estivo-autumnal plasmodium (tertian). |
| 11, 13, 14, 16, and 17. Pigmented ring forms. | 29. Ovoid form. |
| 12. Red corpuscle, showing infection with two "ring forms." | 37. Segmenting form. |
| 18 and 19. Pigmented forms, just prior to segmentation. | 38. Sporozoites. |
| 20, 21, 23, and 24. Round and ovoid forms developed from crescents. | a. Segmenting form of quotidian estivo-autumnal plasmodium. |

physician, and is well told by Markham, in his book entitled *A Memoir of the Lady Ana de Osorio, Countess of Cinchon*, published in London in 1874. Markham says: "In 1638 the Countess of Cinchon, the wife of the Viceroy of Peru, lay very ill with tertian fever at Lima, the capital city. The news was carried to Canizares, the Corregidor of Loxa, a town among the Andes, in the present Ecuador. Though the natives of Peru were unacquainted with the curative power of the bark, those of the more northern-lying countries appreciated its worth, and from them Canizares obtained the secret. He therefore sent a parcel of it to the vice-queen. Her physician, de Vega, agreed to its employment, and she recovered in a short time. In 1640 the Countess returned to Spain, and carried with her a large quantity of the precious bark, which she distributed about her native place in the vicinity of Madrid. De Vega followed and brought likewise a large amount of the bark to Spain, which he sold at Madrid for a hundred orrales a pound. The Countess employed the bark so extensively that for a long time it bore the name "Countess' Powder (pulvis comitissæ)."

In 1820 Pelletier and Caventou discovered the alkaloids quinine and cinchonine in the bark, and in 1852 quinidine was isolated. Although the great value of the bark was well known in Europe shortly after its introduction, it was many years before it became generally used in practice, and it was not until after the discovery of the malarial plasmodia by Laveran, in 1881, and his observations regarding the action of this drug upon these parasites that the explanation of its marvellous efficiency in the treatment of malarial fevers was demonstrated.

The Action of Quinine upon the Malarial Plasmodia.—When properly administered quinine will invariably destroy the malarial plasmodia, and its action upon these parasites proves it to be a true specific. Binz was the first to prove that this drug is a protoplasmic poison, and his researches have been confirmed, as regards the malarial plasmodia, by numerous investigators. I have devoted much study to this phase of our subject, and have published my results in full elsewhere, and will here give only the essential changes observed in the plasmodia after the administration of quinine.

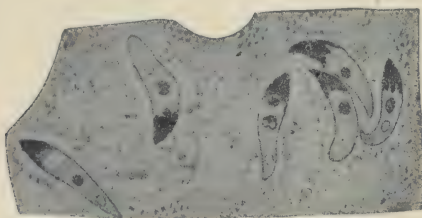
The action of the drug upon the various species of malarial plasmodia has been studied by several observers, especially Golgi, Romanowsky Mannaberg, and Schaudinn upon the tertian plasmodium (*Plasmodium vivax*); Antolisei, Golgi, and Mannaberg upon the quartan plasmodium (*Plasmodium malariae*); and Marchiafava and Bignami upon the estivo-autumnal plasmodium (*Plasmodium falciparum*). My own observations have been made upon all of the species of human plasmodia, and may be summarized as follows:

Plasmodium Vivax (The Tertian Malarial Plasmodium).—The morphological changes observed in living individuals of this species and produced by quinine are the following: An initial stimulation of ameboid activity, followed by a decrease in activity, and eventually cessation of motion; a granular degeneration of the protoplasm, with an increased refractive index; fragmentation of the parasite, followed by the apparent

extrusion of the fragmented organism from the red blood corpuscle; a marked decrease in the amount of pigment developed, thus showing its influence upon the metabolism of the parasite; similar changes in the *gametes*, but only apparent in the earlier stages of the development of these forms. The fully developed tertian *gamete* presents no changes in morphology after the administration of quinine; but if the drug be administered early in the infection, either no *gametes* will be produced or the number will be greatly diminished, and many of them will be destroyed during the early stages of their development.

In specimens of *Plasmodium vivax* stained with Wright's stain the following changes in morphology may be observed after the administration of quinine: The protoplasm stains a more intense blue, while the chromatin of the nucleus takes an almost black color instead of the normal ruby red; fragmentation of the parasite is clearly demonstrated, many of the fragments being void of pigment and chromatin. Atypical division and decrease in the amount of chromatin in the presporulating parasites and the absence of chromatin from many of the *merozoites*, or spores, is frequently observed, thus proving that the latter are incapable of further development.

FIG. 5



Oökinetes of malarial parasites in stomach of mosquito thirty-two hours after patient's blood has been sucked. (Grassi.)

Similar changes are observed in stained specimens of young *gametes*, but the fully developed *gametes* do not present any changes in the staining reaction after the administration of this drug.

Plasmodium Malariae (*The Quartan Malarial Plasmodium*).—The effect of quinine upon this species of plasmodium is practically identical with its effect upon *Plasmodium vivax* and I have never observed any appearances which would lead one to believe that this species is more resistant to the action of the drug than is the tertian plasmodium.

Plasmodium Falciparum and Plasmodium Falciparum Quotidianum (*The Estivo-autumnal Plasmodia*).—The effect of quinine upon the estivo-autumnal plasmodia is similar in both species. I have studied the action of the drug upon every stage in the human life cycle of these plasmodia, with the exception of the fully developed pigmented stage and the sporulating stage. The latter stages of development are rarely observed in the peripheral blood, it being necessary to puncture the spleen in order to obtain material for study, and because of this my observations have been

so limited as regards these stages that I do not feel justified in drawing any definite conclusions from them.

In fresh blood the young plasmodia appear more refractive after the administration of quinine, while ameboid activity is greatly stimulated at first, but eventually ceases entirely. The protoplasm of the parasites appears more granular than normally, and in the pigmented organisms the drug appears to produce a marked granular degeneration of the protoplasm.

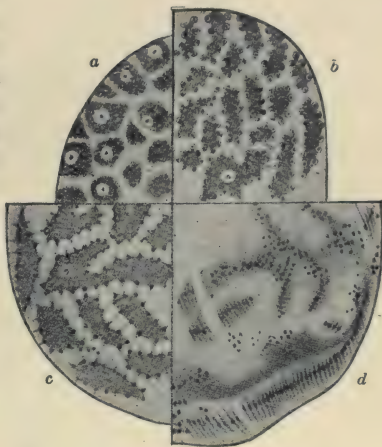
In *stained* specimens it can be very easily determined that quinine produces marked changes in the morphology of these plasmodia. The protoplasm stains more intensely than normally, while the chromatin stains a dark violet rather than the bright ruby-red color which is normal. The vesicular portion of the nucleus is generally absent, and extrusion of the chromatin from the young parasites is sometimes observed to have occurred. In the larger unpigmented forms and in

FIG. 6



Transverse section of the stomach of *Anopheles*, showing cysts of pernicious parasites. (Grassi.)

FIG. 7



Stages of sporogony of malarial parasites in mosquito: a, four and one-half days after ingestion; b, five to six days after ingestion; c, seven days after ingestion; d, eight to fourteen days after ingestion. (Grassi.)

the pigmented parasites the changes observed after the administration of this drug are similar to those which have been described as occurring in the tertian and quartan plasmodia, consisting of alterations in the staining reactions of the protoplasm and chromatin, fragmentation of the plasmodia, and decrease in the amount of pigment and chromatin. The decrease in the latter is very significant, as it indicates that atypical sporulation may occur, leading to a decrease in the number of spores or to sterile organisms.

I have never been able to demonstrate that quinine produced any morphological changes in the *gametes*, or crescents, of the estivo-autumnal plasmodia after they have reached their complete development, but in the early stages of growth this drug is capable of destroying them. The administration of quinine prevents the form of intracorporeal conjugation, which I believe leads to relapses, and the fact that recurrences do

not occur when the drug is properly administered, and that it has this effect upon conjugation is proof that the process is probably the cause of such relapses. The observation of Ehrlich and others upon certain strains of trypanosomes which become resistant to drugs which usually destroy them, if the drug is administered in small doses for a considerable period, is of significance in the treatment of malaria, for it may be that the plasmodia become accustomed to quinine if this drug be administered in too small a dose, although we have no evidence that this is true.

Practical Deductions.—Quinine is most efficient in destroying the malarial plasmodia if given in divided doses at regular intervals, for my observations prove that the drug is capable of destroying the parasites at every stage of the human life cycle, with the possible exception of the sporulating stage; but the previous administration of the drug, even at this stage, causes atypical division, the number of spores being reduced, while many of them are sterile, as shown by the absence of nuclear chromatin.

If the drug be administered in one large dose just before sporulation of the plasmodia, many of the young parasites are at once destroyed, but those which escape for a few hours are able to develop, the drug having been excreted before the cycle of development has been completed. Given in this way, some of the stages of development escape entirely from the action of the drug, and thus more parasites reach maturity. If, on the other hand, after a moderate sized initial dose the drug be continued at intervals of every three or four hours the parasites which have escaped the first dose are not free to develop normally, but are continually exposed to the action of quinine, which is always present in the blood.

The conclusion I have reached regarding the time of administration of quinine in malaria is the result of the study of the morphological changes produced in the plasmodia by quinine, and is justified by actual clinical experience. The clinical records of over 2000 patients suffering from the various forms of malarial fever, in which quinine was administered in divided doses at regular intervals, prove conclusively that this is the best method of administration. In all of these cases recovery from the infection was prompt and more rapid than in similar cases in which the drug was administered in one large dose prior to or immediately following sporulation. In the tertian infections a second chill very rarely followed the interrupted method of administration, although most of the patients showed a rise of temperature upon the day of the next expected paroxysm. In only about 20 per cent. of these did the temperature reach 101° F., and in most of them it did not rise above 100° F. In the quartan infections a second paroxysm never occurred if the drug was administered in this way, provided the initial dose was given within twelve hours after the first paroxysm. In the estivo-autumnal infections the method of administering quinine in divided doses at regular intervals during the twenty-four hours should always be employed, for it is generally impossible to ascertain the exact time of the expected paroxysm in most of these infections, so that it is impossible to give the drug in one large dose, in the expectation of destroying the *merozoites* before they

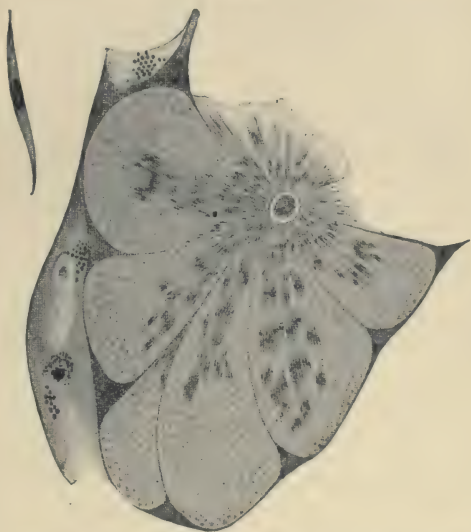
infect the erythrocytes. In the many hundred cases of these infections in which I have seen quinine administered in divided doses, the results have been most satisfactory, provided the treatment was begun before the development of pernicious symptoms, and even in the pernicious cases the best results are secured by giving the drug hypodermically in divided doses. In ordinary cases of estivo-autumnal malaria the administration of quinine in divided doses results in a fall of the temperature to normal within three days, and in the milder infections the fever disappears within two days. In this class of malarial fevers quinine should never be administered in one large dose during the twenty-four hours, as such treatment invariably results in the febrile condition persisting for several days, during which time pernicious symptoms may develop. I have observed very serious results follow the administration of the drug in this manner, some of the patients so treated dying from pernicious attacks which might have been prevented or controlled had the drug been administered in divided doses at regular intervals of time.

Having briefly discussed the action of quinine upon the malarial plasmodia, the treatment of the infections caused by these parasites will be considered. The treatment of the malarial infections may be divided for this purpose into *remedial* and *prophylactic*.

Remedial Treatment.—We have seen that the efficiency of quinine in the treatment of malarial disease is due to the fact that it kills the organisms concerned in its causation, and that the drug is most effective if administered in divided doses at regular intervals of time. It must be admitted that now and then one meets with an infection in which quinine appears to be powerless to limit the course of the disease, but a careful study of such instances will invariably demonstrate that the drug was given too late to prevent the fatal result, or that it has been improperly administered. As I have said elsewhere, "*The successful treatment of malaria by quinine depends wholly upon the proper administration of the drug.*"

While many of the mild tertian and quartan infections recover spon-

FIG. 8



Section through tubule of salivary gland of anopheles mosquito, showing estivo-autumnal sporozoites; above, an isolated sporozoite highly magnified. (Grassi.)

taneously, and even the estivo-autumnal infections may follow the same course, it is of the greatest importance that every case of malarial fever be thoroughly treated, for while the milder infections tend toward spontaneous recovery, they may at any time become malignant, and though they do not, repeated malarial paroxysms decrease greatly the vital resistance of the infected individual, and lead to a condition of anemia and lack of vitality which, in many tropical and subtropical countries, explains the lack of industry and prosperity of the inhabitants. From the *prophylactic* standpoint the thorough treatment of every malarial infection is essential, for we must admit that every individual who has suffered from repeated attacks of untreated malaria is a source of infection to others. It is much to be deplored that a very considerable percentage of the malaria present in every locality is due to careless treatment by the attending physician, the patient being allowed to return to his duties after the disappearance of symptoms, with no instructions regarding the continued use of quinine.

The Choice of the Preparation of Quinine.—The preparation of quinine to be used in the treatment of malarial infections will depend upon the nature of the infection and the condition of the patient. Of the eighteen or more salts of quinine which have been used, only a limited number are deserving of attention, and it is much better to be thoroughly familiar with one or two of them than to have a speaking acquaintance with all. Practically the most useful are the sulphate, the tannate, and the acid hydrochloride (bihydrochloride or bimuriate of quinine). For general use the sulphate is the salt usually preferred, because it is cheap and reliable, although it is quite insoluble, and is irritating to the mucous membranes of many individuals. However, comparatively few people object to this salt, and as it can be easily procured, it is best adapted for general use. It should not be used for intravenous or hypodermic injections, the acid hydrochloride being most suitable for this purpose. The bihydrobromide, the lactate, and the bichloride of quinine and urea may also be used by the hypodermic methods. The acid hydrochloride is the preparation which should always be used when one wishes a readily soluble salt, it being dissolved in the proportion of one part of the salt to 0.96 part of water, or less than its own weight. The following table gives the principal salts of quinine and their solubility:

Salt.	Alkaloid in salt.	Solubility in cold water
Sulphate	73.5 per cent	In 800.00 parts.
Acid hydrochloride or		
Bihydrochloride . . .	72.0 “	In 0.96 “
Hydrobromide	76.6 “	In 45.00 “
Bihydrobromide . . .	60.0 “	In 7.00 “
Bisulphate	59.1 “	In 11.00 “
Phosphate	76.2 “	In 420.00 “
Valerianate	73.0 “	In 120.00 “
Lactate	78.2 “	In 10.00 “
Salicylate	70.1 “	In 225.00 “
Arsenate	69.4 “	Very slightly soluble.
Tannate	20.0 “	Very slightly soluble.

In children the tannate of quinine is a good preparation to use, as it is not so bitter in taste as are the other available salts of the drug, and if given in chocolate or made into a confection with the latter it is almost tasteless. This salt is also an excellent preparation to use as a prophylactic. From the observations of Nardelli it appears that it is absorbed more slowly, and is more completely oxidized than the other salts of quinine, so that while it is efficient as a prophylactic, it should not be selected when a rapid and strong action of the drug is desired, the more soluble salts being indicated under such circumstances. Where, however, a slow and durable effect is desired, as in prophylaxis and the treatment of mild recurrent infections, this salt is to be preferred. Celli believes that it should be used whenever possible for the following reasons: Its almost complete absorption from the alimentary tract; the fact that it is more slowly eliminated from the body than the other salts of quinine, thus rendering it of great value in prophylaxis; because it is better tolerated by the stomach, intestines, and nervous system; is almost tasteless, and the cheapest of the tasteless preparations; and finally, because it has a remedial action upon diarrhea or dysentery complicating malaria. This salt is the one used in Italy in the extensive prophylactic operations of the Italian Government, but for some reason it has not become popular in this country, where it deserves a more extended use, especially in the prophylaxis of malaria. I have found it an ideal salt of quinine for the treatment of malaria in children.

The Time of Administration of Quinine.—I have already discussed the effect of quinine upon the malarial plasmodia, the results of my observations, as well as those of others, proving that the drug acts upon practically every stage in the development of these organisms in the human body, its action being most marked upon the free *merozoites* (spores) and the young intracellular forms of the parasites. From this it follows that the best results will be obtained in the treatment of malaria if the quinine be constantly present in the blood, and this is best secured by the administration of the drug in divided doses at regular intervals. Those who advocate the administration of the drug in one large dose just prior to or just after a paroxysm, in the hope that all of the liberated spores will thus be killed, lose sight of the fact that the drug also acts upon other stages in the development of the plasmodia, and that many of the spores escape even under the most favorable circumstances. In addition, the administration of a single large dose of quinine increases very greatly the discomfort of the patient, and is never followed by as rapid recovery as when the drug is administered in smaller doses at regular intervals. It cannot be denied that good results often follow the administration of a single large dose in tertian and quartan infections, in which class of cases the time of the expected paroxysm can be accurately foretold; but it is also true that better results are obtained with the divided dosage and the patient saved much discomfort. In the estivo-autumnal infections the administration of a single large dose of the drug should be avoided except in pernicious cases, where rapid action is required, when the drug should be given by the hypodermic syringe in large doses if

necessary. It is impossible to be sure of the time of the expected paroxysm in most cases of estivo-autumnal fever, so that it is impossible to give a single large dose with intelligence, and this method of administering the drug should be abandoned in such infections. While there are many authorities who still advocate the administration of quinine in a single large dose in the treatment of malaria, I have found, after a long personal experience with these infections, that better results are *always* obtained by giving the drug in smaller doses at regular intervals. To secure the best results in the treatment of malarial infections, quinine should be administered at intervals of three or four hours, in proper amounts, during the *acute* stage of the disease, and morning and evening for some days after the acute symptoms have disappeared. The length of time during which the drug should be taken is discussed later.

The Methods of Administration of Quinine.—In malarial infections quinine may be administered by the mouth, the rectum, subcutaneously, intramuscularly, or intravenously. The exact method of administration should vary with the severity of the infection, the vast majority of our cases responding well to the administration of the drug by the mouth, but in attacks in which pernicious symptoms develop it will be necessary to use the drug hypodermically, injecting it into the muscles or the veins.

Administration by the Mouth.—With the exception of pernicious cases of malarial infection there are but few instances in which the drug cannot be administered by the mouth, in some form. Very frequently we are told by our patients that they cannot take quinine in this way, because of the severe digestive disturbances which result; but most of these symptoms are imaginary, and a little tact and persuasion will result in the patient discovering that the drug may be taken in this manner without much discomfort. Rarely we meet with patients in whom quinine by the mouth excites severe vomiting, or other symptoms of irritation of the intestinal tract, and in such instances it is better to give the drug in some other way. When given by the mouth, quinine may be administered in the form of pills, tablets, wafers, capsules, and in solution. I only mention pills and tablets to unreservedly condemn their use, for even the most soluble pill or tablet becomes insoluble with time, and it will generally be found that those on the market are very insoluble, and that the results obtained by their use are very unsatisfactory. The most efficient form in which to administer quinine by the mouth is in solution, but owing to the intensely bitter taste of the drug this method of administration is frequently objected to and cannot be used in the case of women and children. The confection of the tannate of quinine, or chocolate tablets containing this salt, are especially applicable to the treatment of malaria in this class of patients; the tablets are to be dissolved in the mouth or swallowed whole, as they are very soluble.

The most convenient method of administering the drug, and one from which good results may be expected, is in capsule, and this is the method which will be found of greatest use in practice. The taste is thus disguised and the gelatin capsules are readily soluble. The objection to the

method is that the quinine is liberated *en masse* in the stomach, and is thus liable to prove irritating, but in practice this may be disregarded. Where it is impossible to use capsules, wafers may be substituted.

The ideal method, so far as efficiency is concerned, of administering quinine by the mouth is in solution, and in the case of male adults this method should be preferred, as the drug is more quickly absorbed and there is less danger of gastric irritation. When given in this way the sulphate is the salt usually employed, a drop of dilute hydrochloric or sulphuric acid being added for each 0.065 gm. (gr. j) of the drug, for the purpose of dissolving it. The bitter taste may be partially disguised by syrup of yerba santa or a chocolate syrup.

Administration by the Rectum.—This method of administration has been advocated by some authorities, but I cannot help but think more upon theoretical rather than practical grounds. It will be found a most unsatisfactory method in general practice, and I cannot recommend it save in very rare instances in the case of children. Personally, I have never observed an instance in which this method of administration appealed to me as better than one of the other methods in common use. Absorption of quinine from the rectum is very slow, as a much larger dose has to be employed; the injection, if containing enough quinine to be of any service, is most irritating, and rectal pain and tenesmus are almost sure to result. I believe that most children would object more decidedly to this method of administration than to administration by the mouth in the form of chocolate troches of the tannate of quinine, or the sulphate in capsule or in chocolate syrup.

However, if the drug be given in this manner, the dose should be at least one-half again as much as by the mouth, and it is best given in the form of a suppository, although absorption will be more rapid if it be given in solution. The solution should consist of saline solution containing the proper dose of the drug, and from five to ten drops of tincture of opium. The enema should not exceed 150 or 250 c.c., as it is necessary that it be retained in order to be of service. In very young children the opium should be omitted, the quantity of solution reduced, and the injection made with gentleness and care.

Hypodermic Administration of Quinine.—Within recent years there has arisen a tendency in the profession to administer quinine hypodermically in all malarial infections, a tendency much to be deplored, as it has led to serious results and to much unnecessary alarm as to the danger to life of ordinary malarial infections. This tendency is especially prevalent in the subtropics and tropics, where estivo-autumnal fevers are common, and the opinion appears to be growing among medical men that these forms of infection can only be treated successfully by the hypodermic injection of quinine. Nothing can be more erroneous than such an opinion, and in an experience of many years, during which time I have observed thousands of cases of estivo-autumnal malaria, I have found *the hypodermic use of this drug but very rarely necessary, and then only in pernicious cases*. Osler has well said, "The physician who at this day cannot treat malarial fever successfully with quinine should abandon

the practice of medicine," and I would add that the same course should be followed by the physician who cannot treat the vast majority of his malarial cases without recourse to the hypodermic method of administering the drug. This method should only be used in those instances in which the effect of the drug is desired as rapidly as possible, as when pernicious symptoms are present or where the patient is weakened from other diseases and the malarial infection threatens to bring about a fatal result. In rare instances the drug cannot be given by the mouth, and if such be the case, the hypodermic use of it is indicated.

The salt of quinine to be used in hypodermic injections should be easily soluble, and for this purpose the acid hydrochloride of quinine is most valuable, as it is soluble in less than its own weight of water. The bihydrobromide and the bichloride of quinine and urea are also good preparations for use in the hypodermic syringe. These salts are often difficult to procure, and if such be the case, the bisulphate which is soluble in eleven parts of water may be employed.

Subcutaneous Injection.—For this purpose I have found the following solution most serviceable:

R—Quininae hydrochloridi acid. (bihydrochloride)	5 gm. (gr. lxxv)
Aquæ destillatæ	10 gms. (ʒiiss)

In this solution 1 c.c. (m15) contains 0.5 gm. (gr. viiss) of the drug.

In giving quinine hypodermically the greatest care should be taken that everything used in making the injection is sterile, as well as the skin of the patient over the area selected for injection, for unless this be done, abscesses and even extensive sloughs of the skin may follow the injections, and tetanus may develop after the use of a dirty syringe or an infected solution. The skin over the region to be injected should be thoroughly scrubbed with hot water and soap, washed off with ether and alcohol, and brushed over with Lugol's solution or tincture of iodine. The syringe should preferably be a glass one, and whatever material it is constructed of should be sterilized before use. The quinine to be used should be sealed in glass tubes and sterilized in the hot-air chamber. The injection should be made into the subcutaneous tissue and not into the skin, and carelessness in this regard is often followed by abscess formation and skin necrosis. The solution should be injected slowly, and after the needle is withdrawn the site of the puncture should be washed with alcohol and covered with a collodion dressing.

While many practitioners inject quinine subcutaneously, I am of the opinion that intramuscular injection is far better, and that it should replace subcutaneous injection altogether.

Intramuscular Injection.—This method of administration was recommended by Koch in recurrent malarial infections and in severe estivo-autumnal infections, though pernicious symptoms might not be present. I have never found this method necessary in cases of recurrent malaria, or in the vast majority of estivo-autumnal infections; but in pernicious cases and in patients unable to take quinine by the mouth I believe that intramuscular injections are preferable to the subcutaneous, and of the

greatest value. While it is true that the dose required in intramuscular injection is only about half that required by the mouth, and that patients are cured more rapidly when the drug is administered in this manner, I believe that the discomfort caused by the injections is sufficient to condemn them so far as general use is concerned. They should only be used in the class of cases mentioned as indicating hypodermic medication.

The same precautions should be observed in making these injections that have been described as necessary in subcutaneous injections, but despite our greatest skill it will be found that both of these methods are painful, and that considerable swelling and induration develop about the site of the injection in many cases. The same solution is used in intramuscular as in subcutaneous injections, and the injection should be made deep into the muscle, the glutei generally being selected for this purpose. The bimuriate of quinine in equal parts of water and glycerin is recommended by Maurer and Schuffner for these injections, as they claim that abscess formation occurs less often with this combination. I am of the opinion that if the proper precautions be used in making the injections this accident will not occur whatever the preparation of quinine used. The injection should be made slowly, the needle withdrawn, and the skin massaged over the site of injection, after which the needle puncture is closed with a collodion dressing.

Intravenous Injection.—This method of administration was first introduced by Baccelli, and it is the most valuable one we possess in the treatment of dangerous pernicious infections. Whenever the most prompt effect of quinine is desired, as in patients in a comatose condition, when weakened by repeated severe attacks, or where other methods of treatment have not met with success, the intravenous injection of the drug is indicated. In those cases, not at all uncommon in military practice in tropical countries, in which the first symptom of a malarial attack is the sudden development of coma, this method of the administration of the drug is of the greatest value, and it is more than probable that many infections which have proved rapidly fatal might have been conquered had this method of using quinine been adopted. Bacelli states that the mortality in cases of pernicious malaria treated by subcutaneous or intramuscular injections was 17 per cent., but after the introduction of his method the mortality was reduced to less than 6 per cent. I believe that this method is better than any other in the treatment of pernicious malaria, and that it may well replace either the subcutaneous or intramuscular methods of administration.

The solution which is recommended for injection into the vein is the following:

R—Quininæ hydrochlor. acid.	1.0	gm. (gr. xv)
Sodii chloridi	0.075	gm. (gr. iss)
Aquæ destillatæ	10.0	gm. (℥iiss)

Sig.—The solution must be perfectly clear and the entire amount is injected, the fluid being lukewarm.

The most careful precautions should be taken regarding every step of the injection. The skin of the site selected for the injection must be

sterilized, as has been described, as well as the syringe and the materials used in making the quinine solution. The arm should be corded above the elbow or properly held by an assistant in order that the veins stand out prominently, and the needle should be introduced into the lumen of one of the larger veins from below upward, the needle and the barrel of the syringe being kept as nearly parallel with the surface of the arm as is possible; otherwise, the needle is apt to go through the vein. Care should be taken that all air is expelled from the syringe before it is introduced into the vein, and the injection should be made slowly and carefully. After withdrawing the needle the puncture should be covered at once with an aseptic dressing and a bandage applied sufficiently tight to prevent the formation of a hematoma. The injection may be repeated in the course of four or five hours if no improvement is noticed in the condition of the patient.

This method of the administration of quinine, if properly performed, is absolutely devoid of danger, and is to be preferred to either the subcutaneous or intramuscular methods, as the drug is thus brought into direct contact with the plasmodia. As quinine is a heart depressant, it is always well to give a hypodermic of ether, strychnine, or brandy just before the intravenous injection.

The Dosage of Quinine.—It is probable that no drug used by the medical profession has been so much abused as has the specific for malarial fever, and it is undoubtedly true that the majority of practitioners use too much or too little quinine in the treatment of malaria. Two great errors are committed by most physicians in the treatment of these infections. The first is the use of too large a dose of the drug for a short time; and the second, the cessation of quinine before the infection is eradicated. I have very frequently observed the use of from 5 to 6 gm. (75 to 90 grains) of quinine during the twenty-four hours in mild tertian and quartan infections, while in the more severe estivo-autumnal infections the amount of the drug which is sometimes administered is almost unbelievable. It is sufficient to state that the use of such large amounts of quinine is *never* necessary, and that instead of doing good they greatly increase the discomfort of the patient and delay recovery. I have never observed a case of malaria in which it was necessary to give over 2.5 gm. (gr. xl) within twenty-four hours, and it is my opinion that 2 gm. (gr. xxx) of quinine, properly administered, in divided doses, by the mouth, each twenty-four hours, is amply sufficient in any ordinary case of estivo-autumnal infection, while in the milder tertian and quartan infections a single dose of 1 gm. (gr. xv), if administered either just before or after a paroxysm, will prevent the occurrence of another, and the same amount given in divided doses each twenty-four hours afterward will eventually cure the infection. As I have stated elsewhere, "In my experience with estivo-autumnal infections I have yet to see a single case in which treatment was begun in time that did not recover in a few days when treated with 2 gm. (gr. xxx) of quinine given in divided doses each twenty-four hours, and I have seen scores recover rapidly when but 1.3 gm. (gr. xx) of the drug was administered during the twenty-four hours."

The dose of the drug will vary with the method by which it is administered and with the severity of the infection.

When quinine is used by the hypodermic method, subcutaneously or intramuscularly, a dose of 0.5 gm. (gr. viiss) should be given, and repeated, if necessary, until about 1.5 gm. (gr. xxiv) has been injected. Some severe pernicious infections may require more than this amount, but such cases are very rare, and the drug should then be given intravenously.

When quinine is injected into the veins the dose should be 1 gm. (gr. xv), and if the symptoms continue and there appears to be no improvement within four or five hours, this amount may be repeated. As a general rule, a case which does not respond to the first injection will not to others, and the prognosis is most grave in all such instances.

I have already mentioned the dose to be used in rectal injections, but I have never found this method necessary or desirable, and do not recommend it except in cases in which the drug can be given in no other way.

I have found the following treatment scheme of the greatest value in the malarial infections with which I come in contact, and it is believed that the same scheme will prove equally valuable in such infections in any part of the world.

In tertian and quartan malaria, in those instances in which there is a single infection, the paroxysms occurring regularly, a single dose of 1 to 2 gm. (gr. xv to xxx) of quinine, by the mouth, given during the decline in the temperature, and repeated each day at the same time, may promptly cure the infection; but the preferable method is to give the drug in doses of 0.32 gm. (gr. v) every four hours until 1 to 2 gm. (gr. xv to xxx) is given within the twenty-four hours, and this dose continued until active symptoms have disappeared. After this the drug should be continued for at least one month, the dose being gradually diminished during the first two weeks after the symptoms have disappeared until the patient is taking 0.32 gm (gr. v) per day at the end of the second week, and this dose should be continued for two weeks longer. It is well thereafter to take 0.5 gm. (gr. viiss) of quinine every ninth day for two or three months, especially if the patient has suffered previously from these infections. Taking the drug in this manner will prevent the recurrences which are almost inevitable unless some such method is pursued. In tertian and quartan infections in which the paroxysms occur irregularly, quinine should always be administered in divided doses.

In *estivo-autumnal* infections quinine should be given by the mouth unless pernicious symptoms be present. I have found that 0.32 gm. (gr. v) given every three or four hours until the active symptoms have disappeared, and repeated every five or six hours for three or four days thereafter, will result in rapid recovery in most cases. During the next week the drug should be administered in doses of 1 gm. (gr. iv) every other night on retiring, and for at least two months thereafter the same dose should be administered upon the evening of every sixth or eighth day. Given in this manner, we may expect a cure of almost all of our *estivo-autumnal* malarial infections, and we will not be bothered by

recurrences of the fever. If pernicious symptoms are present quinine should always be given hypodermically.

In children the dose of the drug should be proportioned to age. In children under one year the dose is usually from 0.032 gm to 0.065 gm. (gr. ss to j) the amount to be repeated as in the adult. In pernicious attacks in older children the drug may be used in large doses, with good results. Quinine should never be given to a patient during the height of a malarial paroxysm if it can be avoided. Of course, if pernicious symptoms be present we must administer the drug at once, but in the majority of our cases it can be withheld until the fever is declining. If given when the fever is highest and the other symptoms most severe the discomfort of the patient is greatly increased, and this is a point of some importance in treating children or weak and nervous women. In the latter I have observed violent maniacal delirium follow the administration of a large dose of quinine during the height of the malarial paroxysm.

From what has been said regarding the effect of quinine upon the malarial plasmodia, especially the forms concerned in the life cycle within the mosquito, it is evident that if we thoroughly treat our malarial patients during the initial attack of the disease we will prevent the formation of these bodies, and, therefore, the transmission of the infection to mosquitoes, and later to man. A very great deal of the malaria prevalent in every locality where civilization exists is directly traceable to improperly treated patients. The practice of regarding malarial infections as cured because the active symptoms have disappeared is a most common and a most pernicious one, and one that is responsible for the transmission of a very large proportion of malarial disease. It is but too true that the medical profession is largely to blame for this error, for nothing is more common than to observe malarial patients walking about after only a day or two of treatment, inquiry eliciting the fact that the attending physician has given no directions whatever concerning the continued use of quinine. It must be remembered that *all* malarial infections are resistant to treatment; that the mere disappearance of the symptoms is no index of the destruction of all the plasmodia which may be present; and that a continued course of quinine is absolutely necessary to rid the system of even the mildest malarial infection. In every case quinine should be administered for several weeks after all symptoms have disappeared, in the manner suggested, and only by so doing may we hope to prevent recurrences or the transmission of the disease to others.

Contraindications to Quinine.—While quinine is a specific for malarial disease, there rarely occur individuals in whom the drug cannot be used because it produces dangerous symptoms in them. Idiosyncrasy to this drug exists, as it does in the case of almost every drug with which we are acquainted, but the instances must certainly be very few in which quinine cannot be taken without danger to life. It has been the experience of every physician who has practised in malarial regions that a large proportion of his patients suffering from such infections protest against the use of this drug because of the dangerous symptoms which they claim are produced by its administration. Upon inquiry it will be

found that the so-called dangerous symptoms complained of by these patients are simply the unpleasant ones commonly induced by quinine, and that if firmness be used in insisting upon the use of the drug these patients *can* take it, and that the symptoms produced are those commonly observed after its administration, *i. e.*, tinnitus aurium, vertigo, slight deafness, confusion of thought, and severe headache. However, if the use of the drug is followed by amaurosis, total deafness, dyspnea, syncope, alarming heart action, hematuria, or severe hemoglobinuria, the quinine should be discontinued and some substitute administered. Hemoglobinuria is occasionally produced by this drug, and where there is a history to this effect it is best not to use it if it can be avoided.

The "quinine fever" described by F. Plehn I have never encountered, and while it may occur in some malarial regions, I am of the opinion that it is not due to quinine, but to some unknown factor, probably parasitic in nature.

Many physicians regard *pregnancy* as a contraindication to the administration of quinine because of the observation that in women who abort easily this drug is capable, in considerable doses, of inducing this accident. On the other hand, we know that severe malarial paroxysms will also cause abortion, and I believe that if the infection is allowed to continue untreated this accident is more apt to occur than if quinine be administered. I would say, therefore, that pregnancy is not a contraindication to the use of this drug in malarial disease, for if it be carefully administered in the smallest efficient dose the patient is less apt to abort than if the malarial infection is allowed to go untreated. In pregnant women in whom pernicious symptoms develop the drug should be given exactly as in any other pernicious case, for the prospective mother's life is endangered and we are justified in disregarding that of the child. I have given quinine many times to pregnant women, and have never yet seen the drug produce abortion, although in many instances I have given it in large doses for several days. I cannot but think that the danger of using the drug in pregnancy has been greatly exaggerated, and that most of the instances of abortion following its use have been due to the malarial infection rather than to quinine.

Substitutes for Quinine.—It is a fact that not one of the drugs which have been vaunted as substitutes for quinine have proved to be as efficient as the latter drug, and as many of them are expensive, their use has been limited. The drugs used as substitutes consist of preparations of cinchona, which are less toxic than the salts in general use, and of other drugs which have been found to be beneficial in the treatment of malarial disease. I have never used any of them with as good results as when I used quinine, but circumstances sometimes arise which make their use imperative.

Of the preparations which are really salts of quinine, but which are claimed to be less toxic than those in general use, may be mentioned *euchinin*, *salochinin*, and *aristochin*.

Euchinin has been recommended very highly by Nikastro and Sylvain as a substitute for quinine in malaria. It is a tasteless preparation, and has

to be given in larger doses than quinine. It causes derangement of vision and deafness in many individuals, and it is doubtful, in my opinion, if it possesses any advantages over quinine other than its tastelessness.

Salochinin and *aristochin* are administered in doses one-half again as large as quinine, and are recommended by some authorities as valuable substitutes for the more generally used salts of the drug.

Phenocoll.—The hydrochlorate of phenocoll, a derivative of phenacetin, may sometimes be useful in the treatment of malarial fevers, especially in tertian and quartan infections, but it should not be used in the more severe estivo-autumnal infections. This drug has been studied by Albertoni, Anconi, and F. Plehn, and this is the consensus of opinion of all these investigators. The dose is from 1 to 3 gm. (gr. xv to xlv), but caution has to be observed in its administration, as it may produce symptoms of collapse.

Methylene blue has been quite widely used in the treatment of malaria, and some authorities have reported excellent results, but my experience with it has not been such as to warrant its use except in the mildest tertian and quartan cases. Ehrlich and Guttman first advocated the use of this drug because of the observations of Celli and Guarnieri that it stained the plasmodia while they were still in the circulation. It certainly cannot be compared with quinine as regards efficiency, and such good authorities as Marchiafava and Bignami consider that it is more dangerous than quinine, as it may produce strangury, albuminuria, and severe diarrhea. The drug has been used by Thayer, Ivanoff, and Kunst, with good results in tertian infections, but it should never be used in estivo-autumnal malaria. The dose, given in capsule with a little powdered nutmeg, varies from 0.13 gm. to 0.2 gm. (gr. ij to iij), repeated every four hours. The patient should always be told that after taking the drug his urine will be colored blue, as otherwise the appearance of blue urine may cause him great anxiety.

Atoxyl.—There have been several arsenical preparations recommended in the treatment of malaria by different observers, the latest being *atoxyl*, which has been so largely used in the treatment of trypanosomiasis. It may be said of all of these, including *atoxyl*, that they possess little value, and that they are more dangerous than quinine. *Atoxyl* especially should not be used in the treatment of malarial fever, for it is a dangerous drug, its use in trypanosomiasis having been followed by peripheral neuritis and optic atrophy, with total loss of vision. It is almost criminal to recommend such a drug as this in the treatment of malarial infections when we possess so specific and harmless a one as quinine and others, less dangerous than *atoxyl*, which may be substituted for the specific. It has been suggested that the new preparation of Ehrlich, called "606" (dichlor-dioxy-diamido-arseno-benzol), may prove of service in the treatment of these infections, but the experimental evidence to date does not support this opinion.

I believe that almost every one of our patients suffering from the malarial fevers may be treated with quinine, if the preparation to be used is selected with care and administered in the proper manner, and I have

yet to observe a single instance in which this drug did not cure the disease, so far as active symptoms are concerned, if administered early enough, and in scores of cases where the drug was said to have produced dangerous symptoms I have found that in reality these symptoms did not exist, the patient being frightened by the usual unpleasant symptoms caused by large doses. The substitutes for quinine should never be used if it is possible to avoid it, as they are always less efficient than the drug itself, and often even more dangerous.

General Treatment and Treatment of Pernicious Malarial Fevers.—While quinine is a specific for malarial disease its effect can be greatly enhanced by proper general treatment, which, of course, is symptomatic in character to a large extent. All sufferers from malarial fever should be confined to bed during the active symptoms of the disease and it is best to keep the patient in bed for a day or two after the active symptoms have ceased. It is necessary that patients suffering from estivo-autumnal fever keep the bed for at least two or three days after the cessation of active symptoms, for these infections are very apt to recur or become aggravated by physical strain during the intermission of the paroxysms. It is remarkable how greatly the sufferer may be weakened and exhausted by even one paroxysm of malaria, and for this reason it is always advisable to insist upon rest in bed for a few days. As soon as the patient is seen the bowels should be opened by magnesium sulphate or calomel, for this undoubtedly greatly assists the absorption of quinine. The latter drug should never be administered during the height of fever unless pernicious symptoms are present, as it greatly increases the distress of the patient if administered at that time.

During the *cold* stage the application externally of heat is often comforting and hot drinks are relished, while in the *warm* stage great relief is afforded by sponging the patient with tepid or cold water, or a mixture of equal parts of water and alcohol. When the fever is very high the ice-pack or bath should always be given unless the patient is too weak to react. The use of such antipyretics as phenacetin or acetanilide should be avoided on account of their depressing effect upon the heart. These drugs are not of any benefit in malaria, and their use is to be condemned. If nervousness is excessive, the headache very severe, or vomiting be exhausting, a hypodermic of morphine is to be given, but never unless it is really needed.

During the decline in the fever symptoms of collapse may develop, and then the use of hot baths, the application of heat to the skin, strong coffee, the hypodermic use of salt solution, or venous injection of the same, are indicated. If cardiac weakness be present, a hypodermic injection of strychnine or atropine should be administered, and aromatic spirits of ammonia or brandy by the mouth.

During the first two days of the malarial infection the food should be liquid in character, consisting of broths, gruels, and milk, after which a more liberal diet may be allowed. The patient should not be restricted in the use of fluids during the active stage, and should be encouraged to drink plenty of water or lemonade.

Treatment during Convalescence.—Convalescence from tertian and quartan malaria is usually rapid, but after severe estivo-autumnal infections the convalescence is often prolonged, and unless care is taken may eventuate in chronic malarial cachexia. The diet during this period should be plain and abundant, and quinine should be administered as already described. The use of this drug is absolutely imperative if we desire to avoid a recurrence of the infection, and it undoubtedly greatly hastens the complete recovery of the patient. It is always advisable to administer some preparation of iron or arsenic, or both, to convalescents from malarial fevers, as anemia is invariably present. The Blaud pill, if freshly made, and Fowler's solution are excellent remedies, as is also Basham's mixture. Gentle outdoor exercise, in good weather, should be insisted upon, and every precaution taken against reinfection. The bowels should be regulated and the patient cautioned against over-exertion, either physical or mental. It is always well to recommend a change of climate to those who are so situated as to be able to travel, but the change should not be to a climate either much colder or warmer than the one to which the patient is accustomed. A high, dry region, free from malarial infection, is to be preferred, and it is remarkable how rapid convalescence will be in patients who are able to make such a change.

The Treatment of Pernicious Malarial Infections.—The principal object in view in the treatment of pernicious infections is to bring sufficient quinine in contact with the plasmodia in the quickest possible time. In order to do this it is evident that the drug must be given intravenously, but it should be remembered that quinine in large doses is a heart depressant, and that administered in this way it may have a marked effect upon the circulation in weakened individuals. In order to avoid this, it is always best to precede the intravenous injection of quinine by a hypodermic of ether, brandy, or strychnine. I have already mentioned the proper dose of the drug when given in this manner, and that the acid hydrochloride of quinine is the best preparation to use, although the bisulphate may be used with good results. After the intravenous injection has been given the patient should be treated symptomatically, and the quinine repeated in the course of six or eight hours if no improvement is noted in the symptoms. I believe that in most cases of pernicious malaria it is better to give quinine intravenously than intramuscularly, but in those instances in which the symptoms, while severe, are not threatening to life, the intramuscular injection of the drug may be substituted.

The symptomatic treatment will vary, of course, with the particular form of pernicious malaria with which one may be dealing. In all cases a thorough evacuation of the bowels should be secured as quickly as possible, if constipation be present. In the *algid* form of pernicious malaria, heat should be applied externally in the form of warmed blankets, hot-water bottles, or electric pads, while the use of stimulants, such as brandy or whisky, is indicated. When there is danger of collapse the use of other stimulants, as strychnine and atropine, as well as the injection beneath the skin or intravenously of normal saline solution, should be

adopted. In the *choleraic* type the use of opium to check the diarrhea is indicated, as well as the intravenous injection of salt solution. If the case be one of *bilious remittent fever*, the vomiting, which in these cases is the most exhausting and dangerous symptom, may be helped by mustard plasters placed over the epigastrium, the hypodermic injection of small doses of morphine, and sucking cracked ice or sipping cold champagne. In some instances the vomiting may be stopped by an emetic followed by large doses of subgallate of bismuth.

The high temperature which is frequently present in pernicious cases should be controlled by cold baths or sponging, the use of chemical antipyretics being avoided. The cold bath or cold sponge should be given if the temperature reaches 106° F. by the mouth, precautions being taken to support the heart if there be signs of weakness. When the temperature has been reduced to 102.5° or 102° F. the patient should be removed from the bath and warmly covered in bed. At the end of an hour the temperature should be taken, and if it has risen to 104° F. the bath should be repeated. We can accomplish more by hydrotherapy in controlling the temperature in malarial attacks than by any drug, and the latter should never be used for this purpose. The prompt administration of quinine is the all-important factor in the treatment of pernicious infections, and unless this drug be given all other treatment will prove in vain.

The Treatment of the Complications of Malaria and of Malarial Cachexia.—The malarial fevers are often complicated by other disease processes, and, as a rule, the treatment of these complications is the same as that usually employed when they occur alone. Among the more important complications which require treatment may be mentioned lobular pneumonia, endocarditis, chronic valvular disease of the heart, nephritis, dysentery, and severe diarrhea, and certain acute infectious diseases, as typhoid fever, diphtheria, Malta fever, cholera, and the eruptive fevers. The treatment of all of these conditions will be that usually employed plus the proper administration of quinine to control the malarial element in the case. It sometimes happens that the administration of the latter drug will also result in a cure of the complication, and this is especially true of diarrhea or dysentery complicating malaria, and of some forms of nephritis. I have frequently observed the disappearance of a severe diarrhea complicating a malarial attack, after the administration of quinine, and many cases of dysentery in the tropics and subtropics are cured by treating the malarial infection which causes them. It is now well established that a form of tropical dysentery is due to the malarial plasmodia, and the treatment of this condition is considered in the article in this volume upon "The Dysenteries."

Malarial Cachexia.—After repeated recurrences of malarial infection, extending over months or years, a condition develops in some individuals known as malarial cachexia or chronic malarial poisoning. This condition is often very resistant to treatment, and, unless a change in climate is insisted upon, it may be stated that in the vast majority of cases treatment is of but little value so long as the patient is continually exposed to

reinfection. Treatment consists in the use of those drugs which will build up the blood, the use of quinine to prevent recurrences, and the employment of hygienic measures tending to increase the general health. Of the drugs which are useful as blood tonics, iron and arsenic are especially to be recommended, the former in the form of Bland's pill, the latter in Fowler's solution or combined with quinine as hereafter mentioned. Iron in some form should always be administered, as this metal has an undoubted effect upon the blood-forming organs, thus helping to repair the damage done by the plasmodia and their poisons. Arsenic is best given in the form of Fowler's solution, commencing with four drops after each meal for an adult, and increasing one drop every three days until from 12 to 15 drops are being taken three times a day. Careful watch must be kept for the symptoms of physiological tolerance of the drug, and when these arise the dose should be interrupted for a few days, the same dose being resumed at the end of that time.

The *esanophele mixture*, recommended by Grassi, is a favorite treatment in Italy for malarial cachexia, and also for acute malarial attacks. This mixture is put up in the form of pills or in solution, the formula of the pills being as follows:

R—Quininæ bihydrochloridi	0.100 gm.	gr. iss.
Arseni trioxidi	0.001 gm.	gr. $\frac{1}{85}$
Ferri citrici	0.300 gm.	gr. i vss
Extract. amaræ (Phar. G.).	0.150 gm.	gr. i iss
Each pill to contain the above.		

The dosage is as follows: Children three to six years, one pill at 6 A.M., one pill at 6 P.M.; seven to fourteen years, two pills at 6 A.M. and one pill at 6 P.M. Adults, two pills at 5 A.M., two at 8 A.M., and one at 6 P.M.

Smaller proportions are employed in younger children:

R—Quininæ bihydrochloridi	0.1000 gm.	gr. iss
Arseni trioxidi	0.0003 gm.	gr. $\frac{1}{300}$
Ferri citrici	0.0300 gm.	gr. $\frac{1}{2}$
Extract. amaræ (Phar. G.).	0.1000 gm.	gr. iss

This is known as *esanophele solution*, No. 1, and is for children from one to two years of age. A teaspoonful is given at 6 A.M., 9 A.M., and 12 noon for fifteen days.

For children from seven to twelve months of age, *esanophele solution*, No. 2, is given, each teaspoonful containing the following:

R—Quininæ bihydrochloridi	0.1000 gm.	gr. iss
Arseni trioxidi	0.0002 gm.	gr. $\frac{1}{500}$
Ferri citrici	0.0130 gm.	gr. $\frac{1}{8}$
Extract. amaræ (Phar. G.).	0.1000 gm.	gr. iss

A teaspoonful is given at 7 A.M. and at 10 A.M. for fifteen days.

I cannot speak from experience concerning the merits of these formulas in the treatment of malarial cachexia, but they are recommended

by such authorities as Grassi and Schaudinn. The latter used them in the treatment of chronic malaria and in latent infections, with good results, but I am doubtful if they will be found as useful in acute infections as quinine alone.

Among the mixtures which have been vaunted as a specific in malarial cachexia may be mentioned *Warburg's tincture*. Whatever the merits of the original mixture may have been, it is certain that the mixture as now found on the market is practically valueless. It is a combination of inert drugs with quinine, and whatever benefit is derived from it is entirely due to the quinine which it contains. I believe that the physician and his patients would be benefited if this mixture were eliminated altogether from our therapeutic resources.

The administration of quinine in chronic malarial poisoning is indicated just so long as the patient is exposed to reinfection, or exhibits any of the symptoms of the presence of the plasmodia. It is best to give the drug in full doses if active symptoms are present, and in doses of 0.65 gm. (gr. x) on the evening of every seventh or eighth day if used to prevent reinfection.

The hygienic measures necessary in the treatment of malarial cachexia consist in avoidance of exposure to excessive heat or cold, the wearing of proper clothing, gentle exercise when the weather permits, and, if possible, removal from the region in which the patient has contracted his infection. No one therapeutic measure is so efficient as a change of climate in the treatment of these cases, but care should be taken that the change is not too abrupt and that the locality recommended is free from malaria. Patients who have been living in the tropics should exercise the utmost care, when travelling to a colder climate, to avoid chilling and undue excitement and exertion; and it is always well to take quinine during the journey, and for some time after arrival, for one frequently observes acute malarial paroxysms in patients coming from a tropical to a temperate climate, even though such paroxysms have been absent for weeks or months.

The Treatment of Latent Malarial Infections.—The treatment of malarial infections in which no symptoms are present, but in which the plasmodia may be demonstrated in the blood, will be considered under Prophylactic Treatment; but it is well to remark here that the treatment of every individual showing plasmodia in the blood is imperative, even though no symptoms be absent. Only in this way can we prevent the spread of the malarial fevers, and it is undoubtedly true that if blood examinations were made more frequently than they are now in malarial localities the discovery of much latent infection would result, and treatment of these cases would greatly lessen the amount of malarial infection.

Other Methods of Remedial Treatment.—Some observers have endeavored to treat malaria with *Röntgen rays*, but without success. Schaudinn thoroughly studied the effect of these rays upon some of the protozoa, and his results afford no evidence whatever that such treatment would be beneficial in malarial fever. While it is admitted that long exposure to these rays will injure, and even destroy, the plasmodia,

the method is not practical, in that the danger to the patient attending such long exposures as are required is too great. With so good a specific as quinine it is not necessary to resort to such a cumbersome and inefficient method of treatment as the Röntgen rays.

Serum Treatment.—Within recent years a few observers have endeavored to perfect a serum treatment of malaria, but without success, and it is very doubtful if such a method of treatment ever will be perfected, in the light of what we know concerning the plasmodia causing these infections. The results so far obtained are of little practical interest, and while a prophylactic serum would be a great boon to mankind, it is hardly probable that a curative serum would become popular, owing to the fact that quinine is so efficient in the treatment of the disease. Foremost among those who have worked along these lines may be mentioned Kuhn, in Africa, and Ford, in the United States and the Philippine Islands. The former considers that the disease occurring in horses in Africa, and known as South African horse disease, is really malaria of horses, and that the serum of a horse immunized to this disease will be effective in the treatment of human malaria. As a matter of fact, South African *horse sickness* is caused by a *babesia* and not by a *plasmodium*, and it is illogical to believe that the serum of a horse immunized to one will protect from, or act as a curative agent for, the other. Kuhn's results have not been confirmed, and the general opinion is that his method is of no value in the treatment or prophylaxis of malaria. Major J. H. Ford, of the United States Army Medical Corps, has endeavored to secure an antitoxic serum by inoculating rabbits, monkeys, and goats with blood from individuals suffering from malaria. He believes that he has been able to secure an antitoxic serum from monkeys and goats which has some curative effect upon human malaria, but his results still await confirmation. Much more work will have to be done in this direction before it can be accepted as proved that either immunity or cure will follow the use of such sera.

Prophylactic Treatment of Malarial Infections.—By the term "prophylactic treatment" we mean the use of the specific, quinine, in the prophylaxis of these infections. So far as we know, man and mosquitoes belonging to the *anophelinae* are the only sources of malarial disease, and it is obvious that we may prevent infection either by destroying the malarial plasmodia in man, or the mosquitoes transmitting these parasites. It is not my intention to consider the various methods of destroying the mosquitoes transmitting malaria, or methods of protecting man from their bites, as all of these are described in detail in works treating of the malarial fevers, but to discuss only the means of destroying the plasmodia while they are still in the blood of man.

The basis of quinine prophylaxis is the fact that the administration of the drug will destroy or prevent the development of the plasmodia, with the exception of the fully developed *gametes*, and this latter fact is the one weak point in the method, if we desire to depend upon it alone in prophylaxis. However, if quinine be administered during the initial stage of any infection it will prevent the development of *gametes*,

and if given for a sufficiently long time after their development, will eventually cause them to disappear from the peripheral blood.

In order to be effective, then, the drug should be administered to every individual having plasmodia in the blood and to all those who are exposed to the bites of infected mosquitoes. Koch believed that by this method alone any region can, in time, be freed from malaria; but it would certainly require a long time and ideal conditions to obtain such a result, so that in practice, while quinine prophylaxis is a most valuable method, it should not be depended upon alone, but should be combined with measures for the destruction of mosquitoes.

The method of administering the drug as a prophylactic differs with different observers. It is best given in capsule or in the form of tannate of quinine in chocolate troches. I have found in regions where only the tertian and quartan infections occur, that a daily dose of 0.15 gm. (gr. iiss), given in the evening, is ample for protection in most instances; but in regions where the estivo-autumnal fevers are prevalent, larger amounts will have to be taken. In such regions I have found that the administration of 1 gm. (gr. xv) of quinine, upon retiring, given every seventh day, will be effective in preventing malarial infection. This method I have seen used in some of the most malarial localities in the Philippine Islands, with remarkable results, the malarial rate decreasing over two-thirds after two or three weeks of such treatment. However, better and quicker results are obtained by the administration of 0.65 gm. (gr. x) upon retiring, every third, sixth, and ninth night for two or three weeks after reaching the infected locality; and then using the same amount upon every fifth night thereafter. In patients suffering from active malarial infection the drug should be given as already recommended until the active symptoms have subsided, and then continued, as mentioned in the section upon Remedial Treatment.

In latent infections, *i. e.*, individuals showing plasmodia in their blood, although no symptoms are present, quinine should be administered, as in active infections, until the plasmodia have disappeared, and then given as recommended in prophylaxis. It is important that all latent cases in an infected district be discovered and properly treated, for it is these cases which are continually infecting the mosquitoes and thus increasing the number of human infections. These "carriers," as they may be called, are responsible for the great mass of malarial disease in most places in the tropics and subtropics, and it is almost hopeless to attempt to rid a locality of malaria unless these latent infections be treated. In some isolated instances it has been found possible to destroy all the breeding places of the infecting mosquitoes, and thus to banish malaria; but in most localities it is impossible to get rid of all mosquitoes, and in such places the treatment of the latent infections becomes of prime importance. Such infections can only be discovered by an examination of the blood, and this should never be neglected in any region where antimalarial measures are being conducted. Every inhabitant of the district should have a careful examination of the blood made, and if parasites are found should be treated at once. I believe that in all severely infected regions

the use of quinine as a prophylactic should be insisted upon, and that it should be continued as long as the malarial infections are prevalent. The continued use of the drug, in the doses recommended, is not injurious in the vast majority of instances, and there can be no doubt that it will prevent infection if properly used. The work of the Italian Society for the Study of Malaria is conclusive proof of the value of this method of prophylaxis, Celli claiming that the issue of quinine by the Government, for this purpose, saved no less than 7500 lives in 1905 alone, while he further states that of 59,340 persons taking the drug, only 5.8 per cent. developed malaria, including both initial infections and relapses. In South Italy the percentage of malarial infections has been reduced from 80 per cent. to less than 18 per cent. since the institution of quinine prophylaxis. A great mass of evidence has accumulated, which proves that quinine prophylaxis is of great value in preventing malaria, and that by the use of this method alone it is possible to escape infection in the great majority of instances. The methods of administration of quinine as a prophylactic advocated by other investigators demand consideration. Celli recommends the daily administration of 0.4 gm. of the bisulphate to adults; 0.2 gm. to children, or if the tannate of quinine be used for the latter, the dose should be 0.3 gm. (gr. v.). Koch recommended 1 gm. (gr. xv), administered upon every eighth and ninth day; Ziemann, 1 gm. every fourth day; Laveran, 0.4 gm. to 0.6 gm. (gr. x) every twelve days; and Laborde, 0.1 gm to 0.3 gm. daily. Koch's method has probably been tried more extensively than any other, with the exception of Celli's, and has given good results, although no better, I believe, than some of the other methods. The great secret of success in any of the methods is regularity and persistence in its use, and it is probably true that if faithfully complied with, any of the methods recommended will be found efficient.

The impression that quinine prophylaxis must extend throughout the year in malarial regions is erroneous, for in almost every infected locality the infections are most prevalent at certain times, and it is only during these periods that the use of the drug as a prophylactic is imperative. Even in the tropics there are well-defined malarial seasons, and although a few cases occur throughout the year, it is only during the periods in which the fevers are most prevalent that quinine is absolutely necessary for the prevention of the disease. Thus, for periods of from four to five months in temperate regions to from three to four months in the tropics the use of the drug as a prophylactic may be omitted, with comparative safety, and in some malarial regions the periods of intermission may be even longer. In badly infected regions the drug should be taken throughout the year, especially if pernicious forms of fever be present, and in the case of persons showing the plasmodia in their blood, quinine should be taken until they disappear. Finally, let the physician remember that he will be responsible for much of the malaria present in the locality in which he is living if he does not thoroughly treat his malarial patients with quinine, and consistently urge its use as a prophylactic in infected districts. In this matter the profession has more than a nominal interest,

for the presence of much malarial infection in any place is a reflection upon the intelligence, public spirit, and activity of the medical practitioners of that locality.

I have not spoken of the importance of the examination of the blood as *the* test of the presence of malarial infection. The proper treatment of these fevers depends upon an early recognition, and the only possible way in which a rapid and certain diagnosis of malaria can be made is by a blood examination. There is no excuse today for ignorance regarding this most essential method of diagnosis, or for its omission, and the practitioner who neglects the microscope in the diagnosis and treatment of malarial disease is the one who will fail to recognize many infections, and will allow others to become carriers of the infection to the community in which they reside. No censure can be too strong for the physician who loses a patient from malarial fever because he has neglected making a blood examination and has not recognized the condition present. Pernicious infections are notoriously uncertain in their symptomatology, and resemble, in many instances, other disease processes, and it is only by an examination of the blood that many of them can be recognized. For this reason such an examination should never be neglected in any case of fever occurring in a malarial region.

HEMOGLOBINURIC (BLACK-WATER) FEVER.

Hemoglobinuric or black-water fever is a febrile disease occurring in certain tropical and subtropical regions, characterized by fever, hemoglobinuria, and bilious vomiting. It is of unknown etiology, although believed by many to be due to malarial infection. Within recent years the theory that this fever is due to a specific parasite has been steadily gaining ground, and it must be admitted that this theory best explains the many epidemiological problems connected with the disease.

Etiology and Pathology.—There are three theories regarding the etiology of hemoglobinuric fever, each of which has ardent advocates, but it may be stated that absolute proof of the truth of any one of them has not been furnished, and neither can it be said that any one of them has been disproved so far as experimental evidence is concerned. These theories are: (1) That hemoglobinuric fever is due either directly or indirectly to malarial infection; (2) that it is due to quinine; (3) that it is a disease *sui generis*, and is caused by a specific parasite. While there is some evidence which may be used in support of either of these theories, a careful review of the literature and of the experimental work which has been done upon this disease, together with my own experience, has convinced me that hemoglobinuric fever is not caused by either the malarial plasmodia or quinine, but by a specific parasite which has hitherto escaped our observation. I firmly believe that eventually this parasite will be found to be closely related to the piroplasmata, which produce similar infections in some of the lower animals.

The pathological lesions in hemoglobinuric fever are confined princi-

pally to the kidneys, liver, spleen, blood, and urine. In the viscera mentioned acute congestion and extensive areas of necrosis are found, evidencing the action of a powerful toxin. The areas of necrosis are almost specific on account of their extent, and serve to differentiate the condition pathologically from the malarial infections, in which such extensive areas of necrosis never occur. The blood presents a decrease in the number of red corpuscles and an increase in the large mononuclear variety. The urine presents the usual evidences of an acute tubular nephritis and the presence of more or less hemoglobin, the characteristic clinical symptom of the disease.

Treatment.—The treatment of hemoglobinuric fever has given rise to a great deal of discussion, centring chiefly around the question as to whether quinine should be used as a remedial measure. Those who believe in the malarial nature of the condition advocate the use of the drug despite the fact that in the vast majority of instances no proof exists that this drug is of any benefit whatever, unless the malarial plasmodia have been demonstrated in the peripheral blood, and then appears to be only effective in curing the malarial complication. Some have even considered the drug as a specific, and this, of course, is the only logical conclusion if we believe that the disease is caused by the malarial plasmodia. On the other hand, those who believe in the causative relation of quinine to the disease warn against the employment of this drug, while those who believe in the specific nature of the fever consider that quinine is only useful in cases in which plasmodia are present, thus proving that a malarial complication is present. There can be no doubt but that the drug is useful when a malarial complication exists, and I believe that it should always be used in such instances; but that it has any specific effect upon the real cause of hemoglobinuric fever I cannot believe, and therefore do not consider that it should be used in those cases in which no malarial parasites can be demonstrated.

As the indication for the use of quinine in hemoglobinuric fever is the presence in the blood of malarial plasmodia, it follows that in every case this fluid should be carefully examined and the drug promptly administered as soon as the diagnosis of the malarial complication is made. As this disease occurs in localities in which the malarial fevers are severe in character and of frequent occurrence, it is true that the majority of sufferers from hemoglobinuric fever show malarial plasmodia in the blood just before or during the first days of an attack, and therefore it will be found necessary to administer quinine in a large proportion of patients. If, however, no malarial complication exists, it is my belief that quinine should not be given, as there is no proof that it is of any benefit in uncomplicated hemoglobinuric fever, and it probably does much harm if used in large doses. Deaderick has collected the statistics regarding the effect of quinine upon the mortality rate in black-water fever, and there can be no doubt that the mortality is greater when the drug is used indiscriminately than when it is not used. Of 1821 cases treated with quinine, 472, or 25.9 per cent., died, while of 1006 cases treated without quinine, there were but 112 deaths, or 11.1 per cent.

Unfortunately, these statistics are not based upon the presence or absence of the malarial plasmodia, so that it is impossible to say what the mortality would have been had quinine been given only in those cases in which a malarial complication was proved to exist. I believe that it is safe to infer that had the drug been given only in such cases the mortality would have been much less in the cases treated with quinine, not that the drug would have had any effect upon the disease *per se*, but would have cured the malarial complication and thus have increased the patient's chances of recovery. Another factor has to be taken into consideration in the discussion of the use of quinine in hemoglobinuric fever, and that is the correctness of the diagnosis in many instances. There is no question in my mind but that true hemoglobinuric fever has often been confused with hemoglobinuria following the administration of quinine, and malarial infection, for it is well proved that in certain individuals both quinine and the malarial plasmodia may cause attacks of hemoglobinuria; but these attacks are not true black-water fever, and vary greatly from the clinical picture of that disease as observed in its endemic regions. This mistake has been responsible for most of the confusion regarding the true nature of hemoglobinuric fever, and it is most important that this disease be differentiated from the conditions mentioned before treatment is instituted. This is best done by the microscopic examination of the blood, the clinical picture presented, and the history of previous attacks.

The following rules governing the administration of *quinine* in hemoglobinuric fever are those which I believe should be followed in the treatment of the disease:

1. Quinine should be administered to all patients suffering from hemoglobinuric fever if malarial plasmodia are demonstrated to be present. The dose should be sufficient to cure the malarial infection.

2. The drug should not be given to patients in whom the malarial plasmodia cannot be demonstrated.

3. If hemoglobinuric fever occurs during the administration of quinine for a previous malarial infection, and the plasmodia can still be demonstrated in the blood, the drug should be continued until the plasmodia disappear.

4. If the disease develops during the administration of quinine and no plasmodia can be demonstrated the drug should be discontinued.

5. As there is no proof that quinine has the least effect upon hemoglobinuric fever, and is distinctly harmful if given in uncomplicated cases, it follows that this drug should not be used in the treatment of this disease except when a malarial complication can be proved to exist.

6. In patients giving a history of hemoglobinuria following the administration of quinine the drug should not be given, some substitute for it being used if a malarial infection be present.

Various observers differ somewhat in the rules they adopt regarding the administration of quinine in this disease. Thayer considers that the following are the safest to follow:

1. If the attack occurs spontaneously with a malarial paroxysm, the blood showing the presence of parasites, quinine should be freely administered hypodermically or intravenously.

2. If the parasites have disappeared, either as a result of the paroxysm itself or of doses of quinine already given, it may be well to abstain, at least for a time, from the administration of the drug.

3. If an attack arises in the middle of an ordinary malarial infection, after taking quinine, it is best to abstain, for a time, at any rate, from further use of the drug.

4. If, however, in an attack coming on after quinine the parasites continue to develop, quinine should be again administered, despite the slight possibility of its injurious action. The dangers from the further development of the parasites are probably the greater.

5. In postmalarial hemoglobinuria, quinine is, of course, useless.

Mannaberg gives the following rules regarding the administration of quinine in this disease:

1. When, without quinine preceding, hemoglobinuria occurs and the examination shows the presence of malarial infection, quinine is undoubtedly to be administered.

2. When the hemoglobinuria occurs after one dose of quinine, while the anamnesis shows that the patient previously took quinine without bad effect, and the parasites are present in the blood, quinine is also to be exhibited. If a paroxysm of hemoglobinuria should follow within a few hours, the repetition of the drug should be made dependent upon whether or not the parasites have in great part disappeared. In the former case the quinine may be stopped, at least for a time. But if the blood examination shows that the parasites have increased in number, quinine is to be continued.

3. When the anamnesis shows that the patient suffered previously from hemoglobinuria following quinine, and the blood examination is negative, quinine is to be absolutely avoided.

4. When the case manifests a severe malarial infection (numerous parasites on examination), and at the same time an assured intolerance to quinine in the shape of hemoglobinuria, the decision is very doubtful.

Most authorities do not hesitate to advise the use of the drug when malarial plasmodia are demonstrated, but Deaderick does not believe that it should be given in every case even though the plasmodia be present. He thinks that the drug should only be given in those cases in which the plasmodia show no tendency to disappear after forty-eight hours from onset, or in the rare cases in which the attack of hemoglobinuria corresponds to the sporulation of the malarial plasmodia.

However, I believe that in every case in which the malarial plasmodia are demonstrated quinine should be administered until the parasites disappear, except in patients who invariably develop hemoglobinuria after the administration of this drug, when some substitute for it, as methylene blue, should be administered. Quinine should always be given with caution and used hypodermically, in the form of the acid hydrochloride, the injections being made deep in the muscles or intraven-

ously, in the same dose and manner as described in the discussion upon the treatment of the malarial fevers. The drug can seldom be given by the mouth, as the stomach will not tolerate it long enough for absorption, as vomiting is usually a prominent symptom of hemoglobinuric fever and quinine increases the tendency.

Of the drugs, multitudinous in number, which have been recommended in the treatment of hemoglobinuric fever may be mentioned methylene blue, chloroform, calcium chloride, the modified yellow fever treatment of Sternberg, ether, boracic acid, hyposulphite of soda, salicylic acid, sodium salicylate, and tannic acid. *Methylene blue* has been largely used by some observers, but the results have not been such as to indicate that it is of any benefit unless a malarial complication be present. It should be remembered that this drug is an irritant to the kidneys, and that it will obscure the color of the urine, thus preventing judgment as to the progress of the case based upon the amount of hemoglobin in the latter fluid. This drug can only be useful in those rare instances in which a malarial complication exists which cannot be treated with quinine. In such instances the drug should be administered in capsules, each containing 0.15 gm. to 0.2 gm. (gr. ij to iij), and one capsule should be administered every four hours. The addition of a little powdered nutmeg is said to render the drug less irritant to the kidneys and to prevent strangury. The treatment with *chloroform* advocated by Quennec has ardent advocates, who claim that it increases the amount of urine, controls the vomiting, and prevents or diminishes albuminuria. Quennec's mixture is as follows:

Chloroform	6.00 gm.	($\bar{5}$ iss)
Gum arabic	8.00 gm.	($\bar{5}$ ij)
Simple syrup	250.00 gm.	($\bar{3}$ viiij)

The entire quantity is administered during the twenty-four hours, a sip being taken every ten or fifteen minutes. I have never employed this mixture, but Quennec treated 50 cases without a death, although he combined with it one gram of quinine as well as sulphate of soda. I believe that it should be used with great caution, but deserves a careful trial.

Of late, *calcium chloride* has been recommended in the treatment of hemoglobinuric fever, especially by Vincent, who claims that it will not only prevent the disease, but that it will cure the majority of cases. This drug has been used with success in paroxysmal hemoglobinuria, and as it stimulates rather than depresses the heart, it appears to deserve an extended trial in the treatment of this disease. It may be given by the mouth or hypodermically. If given by the mouth, from 3 to 5 gm. (gr. xx to xl) should be administered in divided doses during the twenty-four hours, while if given hypodermically, Billet recommends the subcutaneous injection of from 100 to 200 c.c. of the following, twice or thrice a day.

Calcium chloride	4 to 5 gm.	(gr. xxv to xxx)
Sodium chloride	10 gm.	(gr. lx)
Distilled water	1000 gm.	($\bar{1}$ quart)

Deaderick has used calcium chloride in a small number of cases, and does not think that the results are as favorable as have been reported by Vincent and others. However, it must be confessed that this drug more nearly answers the requirements of a specific in this disease than any other from a theoretical standpoint, and I believe that it should be given a thorough trial before it is abandoned. The drug should never be used for more than three or four days in succession.

The *Sternberg treatment of yellow fever*, slightly modified, is highly commended by Hearsey, who has used it in many cases. His formula is as follows:

Carbonate of soda	0.325 gm.	(grs. v)
Bichloride of mercury	0.001 gm.	(grs. $\frac{1}{80}$)
Distilled water	30.000 gm.	($\frac{3}{4}$ ij)

The entire amount is given every hour until the hemoglobinuria ceases, but the administration should be carefully watched, and sometimes the mixture cannot be used, owing to gastric irritation. The mercury in this combination may have some effect upon the specific parasite causing the disease, if such exists, and in this way the good results following its use may be explained.

Cardamatis recommends the administration of *ether*, claiming that it stimulates the heart and relieves the vomiting, and that even in cases in which suppression has occurred this drug will often bring about recovery. The dose is one teaspoonful in simple syrup, administered every three hours, and if suppression occurs he gives the same dose every hour, besides 1 c.c. of ether hypodermically every three hours. There is insufficient evidence, as yet, of the exact value of this mode of treatment.

Salicylate of soda, salicylic acid, and boracic acid have all been used in the treatment of hemoglobinuric fever, but without any beneficial results. The use of tannic acid in the hope of controlling what was supposed to be a hemorrhage has not been attended with success, and this drug should not be used in the treatment of the disease. Hyposulphite of soda has been used by some physicians in black-water fever regions, but, so far as known, without any definitely favorable results. From this summary of the drugs which have been used in the treatment of hemoglobinuric fever it is evident that we do not possess a specific. The calcium chloride treatment deserves a more extended trial, and the chloroform treatment of Quennec, the modified yellow fever treatment of Sternberg, and the ether treatment of Cardamatis are also deserving of more extended study. Quinine should only be used when a malarial complication is known to exist, while the other drugs mentioned are best omitted in treatment.

General Treatment.—Much depends upon careful nursing and the treatment of symptoms as they arise. Upon the first suspicion of the onset of the disease the patient should be confined to bed and warmly covered, at the same time being encouraged to drink freely of hot drinks or of water. The idea, held by many, that the occurrence of bloody urine indicated a hemorrhage, led to the employment of such drugs as

tannic acid and the withholding of fluids. As a matter of fact, black-water fever is not attended by hemorrhage, but by hemolysis, and as the breaking down of the red blood corpuscles occurs within the bloodvessels, and the liberated hemoglobin is harmful if allowed to remain in the body, the indications are to assist in every way possible the excretion of this substance, and this is best done by the consumption of large amounts of liquid, thus flushing out the kidneys, relieving the congestion of these organs, and preventing suppression of the urine. We should insist upon our patients taking all the fluid possible, even though it may alarm them to pass so much bloody urine. The condition should be explained to them in a simple manner, and they should be assured that danger does not lie in the passage of much urine, but of too little. Too much stress cannot be laid upon the importance of the administration of fluids in this disease, for many patients have been needlessly sacrificed because of the withholding of fluids.

The bowels should be opened by a dose of calomel, followed by magnesium sulphate, and should be carefully regulated, at least one movement being secured each day, but purgation should be avoided.

The fever seldom requires treatment, but in rare instances it may be so high that sponging with tepid water and alcohol is necessary. Chemical antipyretics should be absolutely prohibited, as they are not needed and are always harmful if used. The temperature should be taken at least every two hours, and oftener if there is any indication that it is ascending. In the presence of a complicating malarial infection the best test we possess of the action of quinine is the study of the temperature chart, and under such conditions the temperature should be taken every hour.

Vomiting is one of the most persistent and distressing symptoms we have to combat, and because of the irritability of the stomach it is necessary to administer fluids and food in small quantities or vomiting will invariably ensue. A mustard plaster over the epigastrium will often relieve this symptom, if it be not severe, while the sucking of cracked ice, the use of carbonated beverages, and the sipping of iced champagne will also relieve the vomiting in many instances. As a last resort, morphine should be administered hypodermically, for while it is far from being an ideal remedy in this condition, it does relieve the irritability of the stomach in most patients and thus permits the giving of nourishment. The patient should maintain a recumbent position, and should keep as quiet as possible. Moving about will always increase vomiting, and the bed-pan should be used from the beginning of the disease.

In some patients there exists a tendency to *syncope*, and this should be combated by the recumbent position, and the use of such stimulants as strychnine, digitalis, strophanthus, the aromatic spirits of ammonia, and the inhalation of oxygen. It is best not to use alcohol in any form in the treatment of hemoglobinuric fever, with the exception of iced champagne, in small amounts, for the relief of the vomiting.

Many patients are very restless and nervous, and it is most important that this condition be controlled. The nervousness, which is largely

due to fear, may be allayed by kindly encouragement, especially if the physician possesses the confidence of the patient; and if it is necessary to use drugs, chloral and bromide of potassium are to be preferred, given in as small doses as is possible. In some cases it may be necessary to resort to the hypodermic use of morphine, but this drug should be administered with great caution, and only if absolutely necessary.

Pain in the back, which is a frequent and often a most distressing symptom, may be relieved by hot fomentations and by hot-water bags, or the electric pad placed over the loins. A mustard plaster applied over this region will often relieve the most severe pain, or hard rubbing with a liniment containing oil of turpentine may cause enough counterirritation to relieve the pain.

The occurrence of *suppression of the urine* is generally followed by death, but if promptly treated a small proportion of patients will recover, the flow of urine being reëstablished. This condition is treated by vapor baths or the hot pack, in order to stimulate the action of the skin, hot fomentations, and the administration of plenty of water. Before the use of the hot pack or vapor bath a hypodermic injection of pilocarpine should be given if the patient's heart is in good condition. The loins may be cupped, and free purgation should be secured by the use of magnesium sulphate. Nephrotomy has been recommended when anuria occurs, and there are three instances upon record in which this operation was performed, but the patients all died. It is very doubtful if this operation is of any benefit in cases of suppression of urine due to hemoglobinuric fever. The injection of normal saline solution in large amounts, intravenously or subcutaneously, as well as by the rectum, should be practised in all severe cases of hemoglobinuric fever, even though suppression of the urine has not occurred.

For some time turpentine was largely used as a diuretic in the treatment of this disease, but it can only be harmful because of its irritant action upon the kidneys. For this reason it should never be used in the treatment; there is no better diuretic than water, and if the patient can be prevailed upon to take sufficient water it will act as the best preventive of suppression.

It should not be forgotten that the most important of all factors in the ultimate outcome of an attack of hemoglobinuric fever is the condition of the kidneys, and for this reason, from the very beginning of treatment, we should pay special attention to these organs, in every possible way conserving their function, and avoiding all drugs which will have an unfavorable influence upon the secretion and excretion of urine. In order to be informed regarding the exact condition of the kidneys, frequent chemical and microscopic examinations should be made of the urine and any change indicating a lessening of the function of the kidneys should be the signal for prompt treatment along the lines suggested. Very often a slight embarrassment of function may be relieved by an increase in the amount of fluid taken or by the judicious use of other remedial measures, and the best index we possess of kidney insufficiency is the condition of the urine.

Good nursing is of the greatest importance in this disease, and if the services of a capable trained nurse can be secured the prognosis is infinitely better than if the patient be left to the care of an untrained assistant.

The *diet* during the active symptoms of the disease should consist of fluids, preferably milk and broths of various kinds, as well as oatmeal water and albumen water. As the stomach is generally irritable, the food should be administered in small quantities at frequent intervals, and if it is not retained, nutritive enemata should be given. Digestion is generally good, and if the food can be kept in the stomach it is usually well digested. The appetite, despite the irritability of the stomach, is good, and the patient often craves solid food before it is wise to allow him to have it, as it is always best to keep up the liquid diet until two or three days after the disappearance of the active symptoms of the disease, when plenty of plain, nourishing food should be allowed.

As has been stated, one of the most important points in the treatment of hemoglobinuric fever is the administration of large amounts of fluid, and, therefore, the nurse should urge the patient to take water, in small quantities, at frequent intervals. The patient should be instructed regarding the importance of this measure, and as the amount of fluids he should take is always greater than his desires, he should be told that water in this disease is really a medicine, and that he should regard it as such, and take it when directed. The amount of fluid administered should always be as great, and preferably greater, than the amount of urine passed, and a careful record should be kept of the amount of the latter. Lemonade, carbonated waters, and albumen water are all useful substitutes for plain water, and it is well to alternate the administration of the fluids mentioned.

The patient should not be allowed to get out of bed or to raise himself without assistance, as there is always danger of syncope, and sudden death has occurred when this precaution has not been observed. If a trained nurse is not available, and it is necessary for the patient to leave his bed, he should do so very carefully, abstaining as far as possible from the erect position, and moving about very slowly. As the disease often occurs in those who are so situated that medical assistance can only be obtained by travelling to some more or less distant place, it should be remembered that the patient should always be carried, and should not be moved after the end of the first day's illness, under any circumstances. However desperate the case, it is far better to let the patient rest quietly without medicine than to risk his removal after the acute symptoms are advanced. Under such circumstances the moving of the patient is almost invariably fatal, while a considerable proportion recover if let alone, especially if plenty of fluids be administered. It should be remembered that drugs play but little part in the treatment of this disease, so far as evidence goes, and therefore it is better to let the patient rest quietly without them than to imperil his life by moving him about.

While it is most important that the action of the kidneys be maintained, the patient should not be continually urged to urinate, as it only increases

his anxiety and accomplishes no good purpose. He should be instructed of the importance of voiding the urine, but after he understands this, he should not be reminded of it continually by the nurse or other attendant. If the urine has not been passed for some time, the condition of the bladder should be ascertained, and if retention has occurred the catheter should be used. If the bladder is empty the measures already recommended for suppression should be adopted at once. The amount of urine passed should be measured, and any sudden diminution in this amount should be the danger signal for the institution of active measures looking toward the prevention of suppression. The covering of the patient should be carefully looked after, as any sudden chilling of the surface of the body may lead to most disastrous results. The common cotton pajamas usually worn in hot countries are suitable, but the bedclothing should consist of a cotton sheet and one or more flannel blankets. If sweating is severe the bedclothing and pajamas should be changed as soon as they become damp, as a chill is frequently the result of allowing the patient to lie upon damp bedclothing. The patient is often very sensitive to slight changes in the temperature of the room, and for this reason draughts should be avoided and the utmost care taken that the room temperature be kept as nearly uniform as is possible. Clean sheets and blankets should be warmed before they are used, as well as the clothes worn by the patient.

The bowels should be kept open, but active purgation should be avoided. It is a good plan to administer an enema once or twice a day and avoid the use of cathartics.

Convalescence.—The treatment of convalescence from hemoglobinuric fever demands care and a knowledge of the factors which have to do with the occurrence of a relapse of the disease. Two dangers are to be avoided during convalescence—the occurrence of relapse and of syncope. Relapses are favored by overexertion, either mental or physical; exposure, especially to sudden changes in the temperature or to moisture; the use of alcoholics and excesses of any kind. A change of climate or locality is often imperative, but the change should not be too abrupt from a hot to a cold climate, and even though the change in temperature may not be great, extreme care should be taken that the patient does not become chilled. Many severe and fatal relapses have occurred in patients who have gone from the tropics to a cold portion of the temperate zone and have not been sufficiently careful regarding exposure to the elements.

After a severe attack of black-water fever the heart is generally weakened, and, together with the anemia present, leads to attacks of syncope which may prove fatal. For this reason any sudden exertion should be avoided, the patient should live a quiet life, both mentally and physically, and the heart should be supported by tonic doses of strychnine or digitalis. Alcoholic stimulants should be avoided, if possible, but to those who have been in the habit of using them a glass of wine at meal-time may be allowed. The blood tonics, as iron and arsenic, should be administered, preferably in the form of Basham's mixture and Fowler's solution.

The food should be nutritious, and of a nature to be easily digested. Overeating should be avoided, as it puts an added strain upon a weak heart and leads to indigestion and attacks of diarrhea, which may greatly retard the complete recovery of the patient.

If possible, an individual who has developed hemoglobinuric fever should leave the locality in which he became infected and never return to it, as reinfections or relapses are almost sure to occur if he continue to reside in the endemic area.

Prophylaxis.—In the present unsatisfactory state of our knowledge regarding the etiology of hemoglobinuric fever it is difficult to intelligently recommend prophylactic measures. All of our knowledge regarding prophylaxis in this disease is empirical, and has been gathered from the experience of many observers who have lived in black-water regions. Of course, to those who believe that malaria is the cause of this condition, prophylaxis is a simple matter, consisting in the destruction of mosquitoes, protection from their bites, and the use of quinine. However, these measures have not succeeded in abolishing hemoglobinuric fever from any locality, although they have had some effect upon the incidence of the disease. While I do not believe that malaria has any direct etiological relation to hemoglobinuric fever, in the sense that this disease can only occur in individuals who have suffered from malarial infection, it is undoubtedly true that most patients suffering from black-water fever have suffered from malaria, and, therefore, it would appear that a malarial infection, probably by weakening the resistance of the individual, favors the development of hemoglobinuric fever. Regarded in this way, the prophylactic measures employed against malaria will be found useful in the prophylaxis of black-water fever; and it is true, I believe, that in those regions in which efficient prophylactic measures against malaria have been taken the number of cases of hemoglobinuric fever has also been reduced. That such means are effective, to a certain extent, is no proof of the malarial nature of hemoglobinuric fever, but is an argument in favor of the insect transmission of the disease and its causation by a protozoan parasite. Prophylaxis against mosquitoes not only protects against malaria, but also against filariasis, yellow fever, and dengue, and it is probable that hemoglobinuric fever stands in a similar relation to these insects as do the diseases mentioned.

The known endemic localities should be avoided by travellers, and by foreigners in seeking a place of residence, and the occurrence of so-called "black-water fever houses," in which several cases have been observed, would indicate the wisdom of burning them, as they may harbor the insect which may be concerned in the transmission of the disease.

As relapses are frequent in one who has suffered from hemoglobinuric fever if he remain in the endemic locality, removal from the locality is almost imperative.

TRYPANOSOMIASIS.

The presence of trypanosomes in the blood or cerebrospinal fluid of man is known as trypanosomiasis. At the present time two trypanosomes are recognized as causing disease in man; the first is *Trypanosoma gambiense*, the cause of trypanosoma fever and sleeping sickness; the second, *Schizotrypanum cruzi*, the cause of fever and anemia in children in South America. The most common and important trypanosome infection in man is due to the *Trypanosoma gambiense*, a trypanosome first observed by Forde in Gambia, and fully described by Dutton in 1902. Its connection with sleeping sickness was first demonstrated by Castellani in 1902-1903, who found it in the cerebrospinal fluid of most of the cases of this disease which he investigated. Sleeping sickness is simply the terminal stage of infection with this parasite, the earlier symptoms, which may last for years, being fever, cutaneous eruptions, and enlargement of the lymphatic glands. During the early stage the trypanosomes are found in the blood and glands, only appearing in the cerebrospinal fluid when the symptoms of sleeping sickness occur. These symptoms are a gradually developing drowsiness, deepening into profound slumber, followed by coma and death. The disease is transmitted to man by a species of biting fly, *Glossina palpalis*, in which, according to the recent researches of Kleine, Bruce and others, the trypanosomes undergo a cycle of development.

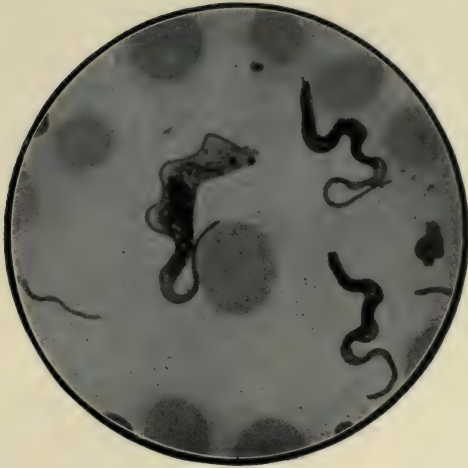
A rare trypanosome disease of man is described by Chagas, of Brazil, who in the blood of a child suffering from fever, anemia, and enlarged lymphatic glands found a trypanosome which he considered the cause of the disease. This organism is transmitted by a bug, *Connorhinus sanguisuga*. His researches still await confirmation.

Etiology and Pathology.—*Trypanosoma gambiense*, Dutton, 1902, the cause of *sleeping sickness*, measures from 16μ to 30μ in length by 1.5μ to 2.5μ in breadth. It is a spindle-shaped organism, the anterior end being pointed or rounded, the posterior sloping gradually into a flagellum. The latter arises from a blepharoplast at the anterior end, and is continued backward, forming the free edge of an undulating membrane, until it reaches the posterior end, where it is prolonged as a free flagellum. The nucleus is oval in shape, and is situated a little posterior to the centre of the body. The parasite has not been cultivated upon artificial media.

Trypanosoma gambiense is transmitted to man by a biting fly, *Glossina palpalis*, and until recently the transmission was supposed to be purely mechanical. However, Kleine, in 1909, demonstrated that the flies do not become infective until after a period of from twelve to twenty days, thus proving that a cycle of development must occur in these insects. His work has been confirmed by Bruce and others. The pathological lesions produced by this parasite are confined to the lymphoid tissues, the skin, and the central nervous system. Enlargement of the lymph glands of the entire body, both superficial and deep, is

PLATE III

FIG. 1



Trypanosoma gambiense in blood of rat. The slender and broad forms are shown.
× 1500. (Novy.)

FIG. 2



Trypanosoma gambiense, showing the common form. × 1500. (Novy.)

always present, while in the early stage of infection various skin eruptions occur. When the terminal stage, known as sleeping sickness, is reached the lesions are found in the central nervous system, consisting of meningeal inflammation, chronic inflammatory lesions of the lymphatics of this system, and degeneration of the spinal cord.

The diagnosis of the infection in the earlier stages is made by finding the parasites in the peripheral blood and gland juice, and in the later stages by their presence in the cerebrospinal fluid.

Schizotrypanum cruzi, Chagas, 1909, was described by Chagas, who found it in the blood of a child in Brazil. It resembles other trypanosomes in structure, but is distinguished by its very large blepharoplast. Chagas has cultivated this trypanosome upon blood agar, has infected dogs and cats, and has demonstrated its transmission by the bug, *Connorhinus sanguisuga*. Upon blood agar several different forms of parasite may be seen, which may be sexual in nature.

The lesions produced by this parasite in man have not been thoroughly investigated, but hypertrophy of the spleen and the lymphatic glands, and severe anemia, are the most prominent objective symptoms.

Treatment.—The treatment of human trypanosomiasis has greatly stimulated research in chemotherapy, but it cannot be said that we have yet secured a specific which will invariably kill these parasites and at the same time prove harmless to the patient. The ideal remedy for trypanosomiasis in man should be non-irritant and capable of killing the trypanosomes at once, for these parasites can become resistant to chemical agents, as has been proved by Ehrlich and others, in the case of atoxyl and many other remedies which have been used in treating trypanosomiasis. After such resistance has been acquired it is useless to continue the administration of the drug. Unfortunately, this ideal drug has not been discovered, and we must admit that after the development of the symptoms of sleeping sickness no treatment yet tried has proved of lasting benefit in this disease, save in isolated instances. The vast majority of patients suffering from sleeping sickness perish eventually, although treatment undoubtedly prolongs life. The only drug which has proved of much service is arsenic, and a large number of arsenical derivatives have been used after observing their effect upon animals suffering from trypanosomiasis. It is true that quite a number of other drugs possess the power of causing the disappearance of trypanosomes in infected animals, together with the symptoms of infection; but in man they have been found useless unless combined with some derivative of arsenic. At the present time the drug most extensively used in treatment of human trypanosomiasis is *atoxyl*, and if the patient is in the early stage of infection, especially if he can be removed from the endemic area, careful treatment with this drug will certainly greatly prolong life, and, in some instances, will cure the infection.

Atoxyl Treatment.—Atoxyl is sodium-p-amidophenyl-arsenate, containing about 25 per cent. of arsenic, but it is the amido group that is supposed to act upon the trypanosomes. After the administration of this drug the trypanosomes present marked changes, degenerative in

nature, and gradually disappear from the blood. However, they are not all killed, for if treatment be stopped they reappear in the majority of instances. Plimmer and Bateman have found that after disappearing from the blood they may be demonstrated in the bone marrow and liver. The drug is administered by intramuscular injection, and the amount used and the frequency and number of injections vary with different observers. Castellani and Chalmers recommend Manson's method—0.12 to 0.2 gm. (gr. ij to iij) of atoxyl by injection every second or third day for two years, or Broden and Rodhain's method—0.5 gm. (gr. viiss) given on two successive days, every ten days for two months, and only repeated if further symptoms develop. Daniels and Wilkinson recommend the use of a 10 per cent. solution of atoxyl in normal saline, 1.2 c.c. (℥ xx) being injected into the gluteal muscles every other day, the quantity being gradually increased until 1.8 c.c. (℥ xxx) is being injected. The injections are continued until the trypanosomes disappear. Under this treatment the symptoms vanish and health is restored, but relapses are frequent and a complete recovery the exception.

Great caution should be used in the administration of atoxyl, as it is a dangerous drug, producing in some cases severe enteritis, peripheral neuritis, and optic atrophy. A number of cases of total blindness have followed the administration of this drug in sleeping sickness, and for this reason endeavors have been made to substitute for it other arsenical derivatives, less dangerous in their action, but with little success. The occurrence of symptoms of gastro-intestinal irritation, of peripheral neuritis, or failing vision should be carefully watched for, and the drug stopped at once.

Atoxyl may be obtained in sterilized glass capsules, and the same precautions should be observed in its administration as are detailed in the discussion of the hypodermic injection of quinine.

Treatment with Other Arsenical Preparations.—Among other arsenical derivatives which are used in the treatment of human trypanosomiasis may be mentioned *soamin* and Ehrlich's *arsenophenylglycin*, the latter a derivative of atoxyl.

Soamin is administered in the same dose and manner as atoxyl, and is highly recommended by Someren, who states that it does not cause toxic symptoms, and that it is as efficient as atoxyl. This opinion is not shared by many other investigators. Ehrlich's *arsenophenylglycin* is from three to four times less toxic than atoxyl, and mice infected with the *Nagana trypanosome* can be cured by it in almost every instance; but the use of this drug in human trypanosomiasis has not been attended with much success, so far as permanent cure of the infection is concerned. It can be obtained in glass capsules, and is administered by intramuscular injection, the salt being dissolved in *cold* water. The dose is 0.5 gm. (gr. viiss) for a six-year-old child and 1 gm. (gr. xv) for an adult. It is given on two successive days, and not repeated unless the trypanosomes reappear or symptoms return. The repeated treatment is only used during the first relapse, atoxyl being substituted if a second relapse supervenes. Eckard has used this drug in 44 cases of human trypano-

somiasis, most of them in the initial stage, with poor results, and toxic symptoms were induced when an effort was made to increase the number of injections. At the present time arsenophenylglycin is generally conceded to be less efficient than atoxyl, but it should be tried if the latter drug cannot be tolerated.

Treatment with Dyes.—Various dyes have been used in the treatment of human trypanosomiasis, both alone and in combination with arsenicals, among them being trypanrosan, afridol, and parafuchsin. All of them are efficient in some of the animal infections, but are most uncertain in man. The trypanosomes may disappear, but sooner or later reappear, and a relapse occurs. *Trypanrosan* can be given by the mouth or intravenously. If given by the mouth, Ehrlich advises a daily dose of 0.20 to 0.25 gm. (gr. iij to iv), which should be administered in divided doses. It is best combined with the intramuscular injection of atoxyl. Afridol and parafuchsin are not recommended in the treatment of human trypanosomiasis, and it may be said that none of the dyes is of much value in the early stage of the disease, and practically valueless in sleeping sickness.

Combined Treatment.—As *Trypanosoma gambiense* frequently acquires a resistance to such drugs as atoxyl and arsenophenylglycin, it has been suggested that the combination with these of other drugs having trypanocidal value might strengthen their action and prevent the acquisition of this resistance. This method is known as the "combined method," and is advocated ardently by some authorities; but, as a matter of fact, we have very little evidence that it is of any greater value in treatment than the use of the arsenicals alone. Among the more important combined treatments are the following:

Atoxyl and Antimony.—Antimony possesses valuable trypanocidal properties, and in some of the infections of the lower animals is capable of effecting a cure. Its use in man combined with atoxyl has not been followed with any great measure of success, and as it is a dangerous drug it has to be administered with great caution. It may be given by intramuscular injection, but this is so painful that it is best given by the mouth. Castellani and Chalmers recommend an atoxyl injection of 0.2 gm. (gr. iij) every third day, or 0.5 gm. (gr. viiss) every fifth day, with the daily administration of sodiotartrate of antimony, 0.15 gm. (gr. ij), dissolved in a large amount of water. Tartar emetic may be administered intravenously, but this method should never be adopted, on account of the danger to the heart from the depressing effect of this drug.

Atoxyl and Orpiment.—Laveran and Thiroux recommend the combined treatment with atoxyl and orpiment, the atoxyl being administered by intramuscular injection and the orpiment by the mouth. The following pill is the one used by them in this treatment:

R—Orpiment	20.0 gm.
Ext. opii	4.0 gm.
Gum,	
Pulv. glycyrrhizæ	q. s.
Make 200 pills.	
Sig.—One pill two or three times a day.	

In the above prescription the opium is added to prevent the diarrhea which so frequently follows the administration of orpiment. This method has been used quite extensively, but it is doubtful if the results have been any better than with atoxyl alone.

Atoxyl and Mercury.—Various combinations of atoxyl with mercury have been used in the treatment of human trypanosomiasis, but with little success. Plimmer and Bateman have found a combination of atoxyl with succinimide of mercury effective in mice infected with nagana, but in man this combination has not been attended with similar success. If the combined treatment with mercury is used, the atoxyl is injected as usual and some preparation of mercury given by the mouth or hypodermically.

Atoxyl and Dyes.—I have already spoken of the use of some of the dyes, such as trypanosan, afridol, and others, in combination with atoxyl. None of them have proved of great value when used in this manner.

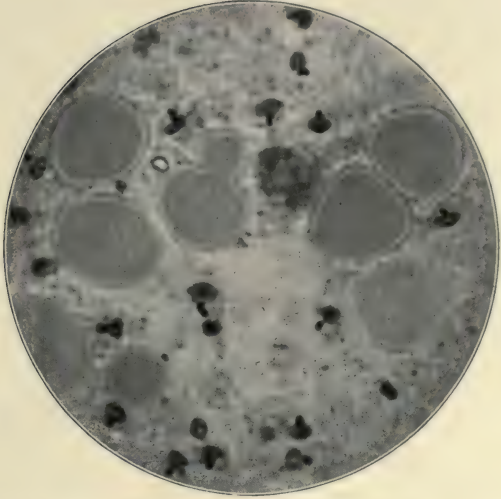
In conclusion, it may be stated that only one drug, *atoxyl*, has met with any decided success in the treatment of human trypanosomiasis, and that, a very partial one. The drug should be given, if possible, not because we expect it to cure many cases, but because it has apparently cured a few, and, therefore, in justice to the patient, it should be used. Its disadvantages are its toxicity and its inefficiency in the majority of cases so far as permanent cure of the infection is concerned. However, it undoubtedly prolongs life, and if given in the earliest stages of the infection will cure some patients. It is doubtful if it is of any use after well-marked symptoms of sleeping sickness have appeared.

General Treatment.—The general treatment consists in good food, exercise, and removal from the endemic area. Tonics, as iron, cod-liver oil, and strychnine, are indicated, and the physical welfare of the patient should be conserved in every way possible. A patient should not be considered as cured until repeated injections of the blood into susceptible animals does not result in infection, and for months after the trypanosomes have disappeared from the peripheral blood this fluid should be examined at intervals and injections made into animals.

The prophylaxis consists in the avoidance of areas in which the transmitting fly, *Glossina palpalis*, is found, or if it be necessary to enter or dwell in such regions, the protection of the person from its bite by the use of headnets, gloves, leggings, boots or shoes, and the proper screening of buildings. As the flies live in the brush along the banks of streams, such areas should be cleared, and also the jungle in proximity of native towns or villages. All patients suffering from trypanosoma fever or sleeping sickness should be isolated in screened buildings, and never allowed to come in contact with flies or other insects.

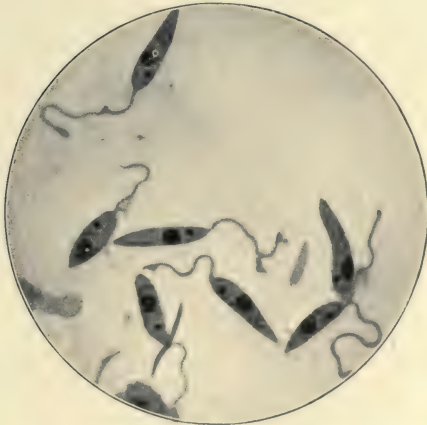
PLATE IV

FIG. 1



Leishmania Donovanii as seen in the Blood of a Man. $\times 1500$.

FIG. 2



Flagellated Forms of *Leishmania Donovanii* obtained from Cultures in Citrated Blood.
 $\times 1500$.

KALA-AZAR, INFANTILE SPLENIC ANEMIA, AND ORIENTAL SORE (LEISHMANIOSIS)

Leishmaniosis may be defined as infection with protozoan parasites belonging to the genus *Leishmania*. At least three such infections are known to exist in man—Kala-azar, or tropical splenomegaly; infantile splenic anemia, and oriental sore, or tropical ulcer. Each is caused by a distinct species of *Leishmania*, is accompanied by more or less specific symptoms, and has a different geographical distribution.

Treatment of Kala-azar.—Kala-azar (dumdum fever; tropical splenomegaly) is a specific disease, characterized by a subacute or chronic febrile course, enlargement of the spleen and liver, and the presence of *Leishmania donovani* in the blood and tissues. It is probably transmitted by means of the bite of some *Cimicidæ*.

Etiology and Pathology.—This disease was long supposed to be a chronic or peculiar form of malaria, and it was not until the discovery of the causative organism by Leishman that this idea was abandoned. In 1900 Leishman observed the parasite in the splenic pulp of a soldier dying of kala-azar, and in the same year Donovan confirmed his observations. Since then every competent observer has found the parasite in the blood or organs of patients suffering from the disease, and it is now generally accepted as the cause. In 1903 Laveran and Mesnil named the parasite *Leishmania donovani*.

Leishmania donovani, Laveran and Mesnil, 1903, belongs to the protozoa, and is invariably found in the tissues of patients suffering from kala-azar. It is always found in the splenic pulp and liver, and may be demonstrated in the peripheral blood enclosed in endothelial cells or leukocytes. The parasite measures from 2μ to 4μ in length by 1.5μ to 2μ in breadth. It consists of a mass of protoplasm, oval or round in shape, surrounded by a limiting membrane, and containing a large oval or round chromatin mass, the nucleus, and a minute chromatin rod, situated near the periphery, and to one side of the large chromatin mass, which corresponds to a blepharoplast. Novy and others have demonstrated the presence of an embryonic flagellum in the parasite as it occurs in man. The organisms may be cultivated in citrated blood kept between 20°C . and 22°C ., Rogers being the first to succeed in cultivating them. In the cultures the parasites develop into flagellated forms, thus indicating that a portion of their life cycle is passed in some other host than man. Investigations by Patton would appear to prove that this flagellate stage is completed in the bed-bug, *Cimex rotundatus*, and that this insect is the transmitting agent.

The parasites invade the endothelial cells and multiply within them, eventually destroying these cells. Hundreds of them may be observed within a single endothelial cell or lying in a granular matrix, probably the remains of such a cell.

The diagnosis of the disease is made by finding the parasites in pulp

obtained from the liver or spleen or in centrifuged blood obtained from a vein in the arm.

Treatment.—The treatment of kala-azar is most unsatisfactory, as we possess no drug which acts as a specific in this disease. The pathology of the condition may be summed up by saying that the parasites invade nearly every organ in the body, especially the spleen, liver, and bone marrow, where they enter the cytoplasm of the endothelial cells, and destroy them. Leishman believes that the parasites are taken up by these cells, but the evidence is almost conclusive that they actually invade and destroy these cells. The invasion of the tissues leads to gross pathological changes, such as cirrhosis of the liver, hypertrophy of the spleen, and fibrosis of both these organs and the kidney. The colon is often ulcerated, and the bone marrow undergoes degenerative changes. From this brief summary of the pathology it is evident that the only hope we have of successfully treating the infection is the discovery of a drug capable of killing the parasites. At the present time such a drug is unknown, and therefore the treatment has to be purely symptomatic and empirical. The disease if once well advanced is incurable, and it is even doubtful if it be possible to cure the infection in the early stages.

For many years *quinine* was regarded as a specific, and was used in enormous quantities, and while it is as useful a drug as we possess, it is really of but very little value. The good results sometimes obtained in alleviating the symptoms are probably due to its action upon the complicating malarial infection so often present, and it is probable that it is only in such mixed infections that quinine is of any real value. However, such authorities as Rogers and Castellani and Chalmers recommend this drug in the treatment of kala-azar. Rogers gives doses of from 4 to 6 gm. (gr. lx to xc) every day until the temperature reaches normal, and 1 gm. (gr. xv) every morning thereafter for several weeks. Castellani and Chalmers recommend the use of the drug by intramuscular injection, combined with atoxyl. They state that one of their cases apparently recovered on a treatment of quinine sulphate, 2 gm. (gr. xxx) and eucinin, 2 gm. (gr. xxx) daily, by the mouth, combined with a daily intramuscular injection of quinine hydrochloride, 1 gm. (gr. xv) alternating with one of quinine cacodylate, 0.25 gm. (gr. iv). I would suggest that the intravenous injection of the drug would be the most efficacious way of administering it, as it would bring the drug into direct contact with the parasites, and in the early stages of the disease might destroy all of them within a short period of time. However, quinine has been used extensively by many practitioners without the slightest benefit. Many other drugs have been tried, but the results have not been encouraging. The very marked effect of *atoxyl* upon trypanosomes has led Manson and Low to consider that it might be of use in this disease, and some successful cases have been reported. This drug should certainly be given an extensive trial before it is condemned. It is given by intramuscular injection, either daily or every second day, in doses of 0.20 gm. (gr. iij), care being taken to avoid the unpleasant and dangerous symptoms which often follow the use of this drug, and which are discussed under the treat-

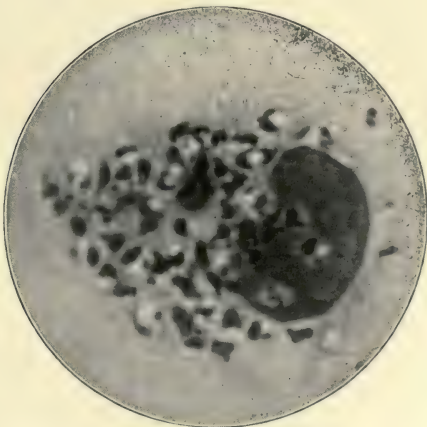
PLATE V

FIG. 1



Flagellated Forms of *Leishmania Infantum* observed in Cultures. $\times 2000$.

FIG. 2



Leishmania Tropica as observed in the Tissues in Oriental Sore. $\times 1500$.

ment of trypanosomiasis. Improvement following the use of atoxyl is slow and the drug is often apparently useless.

Other arsenical preparations and the salicylates have been used in the treatment of kala-azar, but without success. The same may be said of the administration of red bone marrow, although temporary improvement sometimes follows its use, and a few recoveries have been reported. Soamin, an arsenical preparation, has been found of benefit in a few cases, and while practically the same in its effect as atoxyl, is less toxic.

The use of tonics, as iron and strychnine, is indicated to keep up the strength of the patient, and a change of climate is highly desirable. In a few instances the change in climate has led to complete recovery.

Good nursing and a suitable diet are of the greatest importance, and care should be taken that the patient does not overeat, as the appetite is often abnormally great, and overeating is generally followed by serious digestive disturbances. It should be remembered that one of the pathological lesions of the disease is ulceration of the intestine, and, therefore, the food should be unirritating, and as nutritious as possible.

Complications should be treated as they arise. One of the most troublesome is diarrhea, and this is best treated by a milk diet, salol, and subnitrate or subgallate of bismuth. The treatment of the dysentery often associated with kala-azar will be found discussed in the section on the Dysenteries.

Prophylactic Treatment.—In the light of recent experimental evidence it is probable that prophylaxis in this disease depends upon the destruction of the *bed-bug* and avoidance of their bites, as well as the segregation of the infected individuals. Quinine has been used as a prophylactic, but there is no definite evidence that it is of the least value when used in this manner. Infected huts or other buildings should be burned, and the utmost care taken that the clothing and effects of infected persons be disinfected before they are allowed to be placed upon ship-board or taken to other houses or districts.

The Treatment of Infantile Splenic Anemia.—It has recently been determined that a form of splenic anemia occurring in children in Italy, Sicily, and the north of Africa is caused by a parasite belonging to the *Leishmania*, and named by Nicolle, *Leishmania infantum*. This parasite was discovered by Pianese and has been exhaustively studied by Nicolle.

Etiology and Pathology.—*Leishmania infantum*, Nicolle, 1908, is indistinguishable from *Leishmania donovani*, and also undergoes a flagellate cycle of development when cultivated upon blood agar. Nicolle and Novy have succeeded in cultivating this parasite and reproducing the disease in dogs, while Nicolle has been able to infect monkeys, in which the disease experimentally produced is very similar to that seen in children. Nicolle considers that the dog is the natural reservoir of the parasite, as these animals are found naturally infected. The exact method of transmission is unknown, but without doubt it is dependent upon some insect carrier.

The pathology of the disease is similar to that of kala-azar, and the

spleen and liver are greatly enlarged. A severe and peculiar form of anemia is caused by the parasite.

Treatment.—As in kala-azar, so in this infection the treatment has proved unsatisfactory, and at the present time there is no known specific for the disease. Until some method of destroying the parasite while it is still in man is discovered, all that we can hope to do is to treat the symptoms as they arise, and remove the patient from the infected locality to one in which the climatic conditions are favorable to recovery. The same drugs may be used that I have already discussed in the treatment of kala-azar, with the same hope of success. Soamin and atoxyl have been recommended, but there is little evidence that they are of much value. Supportive measures are indicated, and plenty of light, nutritious food. The blood tonics are of service in combating the anemia.

As we are ignorant of the exact method of transmission, the prophylaxis of this disease is obscure. The dogs are undoubtedly dangerous in infected localities, as they harbor the parasites, and should be avoided, or, better, destroyed. Infected children should be isolated, and the same precautions taken in respect to habitations and clothing as recommended in the prevention of kala-azar.

The Treatment of Oriental Sore (*Tropical Ulcer*).—A third form of Leishmaniosis is that known as Oriental sore, Delhi boil, or tropical ulcer. This peculiar affection of the skin is characterized by chronic ulceration and by the presence in these ulcers of mononuclear cells containing the specific parasite, *Leishmania tropica*.

Etiology and Pathology.—*Leishmania tropica*, Wright, 1903, was first accurately described by Wright, of Boston, in 1903, although it may have been seen by Cunningham in 1885, and by Firth, in 1891. Morphologically it is indistinguishable from either *Leishmania donovani* or *Leishmania infantum*, and also develops flagellate forms upon culture media. Nicolle was the first to cultivate this organism, and thinks that the cultural forms may be distinguished from other *Leishmania*. Together with Siere, he was able to produce a typical Oriental sore in monkeys by the inoculation of scrapings from an ulcer in man. The parasites are probably transmitted by flies or some other insect, but the infection is directly transmissible from person to person and is auto-inoculable.

The pathology of the lesion produced by this parasite is that of ulceration in general, with the appearance in the tissues of large mononuclear cells, endothelial in origin, crowded with scores or even hundreds of the parasites. The organisms live within the cytoplasm of the cells, and do not invade the nucleus.

Treatment.—The treatment of Oriental sore depends very largely upon the stage of the disease; the earlier the condition is diagnosed and treated the better the results obtained. As a rule, unless treatment be persisted in and faithfully observed, it is unsatisfactory, and after the lesion is well advanced it will be found that many cases resist any form of treatment which may be employed. In the earliest stage the lesion may be destroyed by a Paquelin cautery or completely excised, but these

measures should not be undertaken unless the lesion be very small and when but little destruction of tissue has occurred. Some authorities advise against such treatment at any stage.

A useful method of treatment is a 2 to 4 per cent. solution of copper sulphate applied locally; or boric acid ointment or silver nitrate may be used, the latter having many ardent supporters. If silver nitrate be used it should be in the form of the solid stick, the surface of the ulcer being lightly touched with it at intervals of two to four days, and then washed with a potassium permanganate solution and covered with an antiseptic dressing. The use of strong acids or caustics is not to be recommended. The ulcer, after it has once become clean and healthy in appearance, will heal slowly if protected from infection, and this should be the principal aim in the treatment of Oriental sore.

In those instances where the ulcer continues indolent, and there appears to be a mixed infection present, thorough scraping of the surface with a Volkmann's spoon, followed by an antiseptic dressing, will be found of benefit in stimulating the healing process. The Röntgen rays are useless, and internal medication of no benefit beyond improving the general condition of the patient.

When the case is first seen, if there are any scabs present they should be removed and the ulcer washed with a 1 to 1000 solution of bichloride of mercury or a weak solution of potassium permanganate, and this cleansing wash should be repeated every day, after which some antiseptic ointment, such as boric-acid ointment or the ointment of oxide of zinc, may be applied. The French practitioners recommend a 5 per cent. ointment of permanganate of potassium.

Many other drugs have been used in the treatment of this infection, but none of them can be said to act as a specific. Despite the most careful treatment, many cases persist for months, and even years, without appearing to be benefited, and it may truly be said that in the vast majority of cases cleanliness and the protection of the lesion from secondary infections is attended with as good results as the use of more radical measures, as scraping, cauterization, and medication with strong antiseptic ointments.

Intercurrent infections should be properly treated, and the general condition of the patient looked after carefully. A change of climate is often most beneficial, and the diet should be generous and nutritious in character. Tonics are generally useful, as anemia and debility are frequently present in patients suffering from this infection, and little good can be expected from the local treatment of the disease if the general health is poor; for this reason every effort should be made to improve the physical condition of the patient.

The *prophylaxis* of this disease consists in the avoidance of insects, protection of the skin from insect bites, and the prompt disinfection of such bites or of other wounds received in regions where Oriental sore is endemic. In order to avoid infecting insects and as direct transmission is possible, the sores should be kept covered with an antiseptic dressing, and healthy individuals should avoid handling what has been touched

by the infected. As there is some suspicion that water may carry the infection, it should be boiled before use, and bathing in public baths or pools should be prohibited. The screening of houses and other buildings in infected localities should be encouraged.

The prophylaxis of *Leishmaniosis* is based very largely upon purely theoretical grounds, and until we can be sure of the manner in which each of these parasites is transmitted, this must of necessity remain so, although in the case of *Leishmania donovani* the work of Patton has pretty clearly demonstrated that this infection is carried by the bed-bug.

HELMINTHIASIS.

By helminthiasis we understand infection with the various worms which live as parasites within man, and in considering the treatment it is necessary to discuss infections with the Trematodes, the Cestodes, and the Nematodes.

The Treatment of Trematode Infections.—Numerous species of the trematodes, flat worms, or flukes are parasitic in man, and the principal ones will be considered separately. The term “distomatosis” or “distomiasis” is often applied to these infections; thus, we may have intestinal distomatosis, pulmonary distomatosis, hepatic distomatosis, and venal distomatosis.

Intestinal Distomatosis.—The following trematodes live as parasites within the intestine of man: *Fasciolopsis buski*, *Gastrodiscus hominis*, *Heterophyes heterophyes*, *Cladorchis watsoni*, *Fascioletta ilocana*, *Fasciolopsis fülleborni*, and Kwan’s fluke. All of these infections depend for recognition upon the finding of the eggs in the feces, and this method of diagnosis should never be neglected in any case exhibiting symptoms of gastro-irritation, especially in the subtropics or tropics.

Etiology and Pathology.—The following summary gives the measurements of the parasites mentioned and of their ova, together with a short description which may prove of service in diagnosis.

Fasciolopsis buski, Lankester, 1857.—This worm measures from 27 to 70 mm. in length by 5 to 14 mm. in breadth. It is flat, thick, and of a brownish color. The eggs measure 0.11 to 0.13 mm. in length by 0.075 to 0.08 mm. in breadth, and possess a delicate operculum. This parasite is said to cause bloody diarrhea and severe nervous symptoms.

Gastrodiscus hominis, Lewis and McConnell, 1876.—This parasite is readily recognized by its slender anterior portion and broad posterior portion, flat, and provided with a ventral acetabulum. It is 5 to 10 mm. long and 3 to 5 mm. broad, and of a reddish color. The eggs are oval in shape, measuring 0.15 mm. in length and 0.072 mm. in breadth, the smaller end being provided with an operculum. The life history and source of infection is unknown. No definite proof exists that this parasite causes disease in man.

Heterophyes heterophyes, von Siebold, 1852.—This is a very small trematode, measuring only 1 to 1.8 mm. in length by 0.3 to 0.7 mm. in

breadth, and occurs in man, dogs, and cats in Egypt. The eggs are oval in shape, measuring 0.02 to 0.03 mm. in length and 0.015 to 0.017 mm. in breadth. They contain a miracidium when voided. This parasite lives in the small intestine, but the life history and source of infection is unknown. It does not appear to produce disease in man.

Cladorchis watsoni, Conyngham, 1904.—This fluke measures from 8 to 10 mm. in length by 4 to 5 mm. in breadth, and is found in Africa. The ova measure 0.12 mm. long and 0.08 mm. broad. The parasite is yellowish red in color and lives in the small intestine. The life history and mode of infection are unknown. It produces diarrhea and anemia in man.

Fascioletta ilocana, Garrison, 1908.—This fluke is found in natives of the Philippine Islands. It measures from 4 to 6 mm. in length and 0.75 to 1.35 mm. in breadth. The ova measure from 88.8μ to 114.7μ . in length by 53.5μ to 81.9μ in breadth. The life history and mode of infection are unknown. It is probably a non-pathogenic species.

Fasciolopsis fülleborni, Rodenwalt, 1909, and Kwan's fluke, described by Heanley, have only been observed in one case, and will not be described.

Treatment.—It will be observed that *Fasciolopsis buski* and *Cladorchis watsoni* are the only flukes inhabiting the intestine of man which have been proved to produce disease, and the treatment of these infections, as well as of all the intestinal infections with flukes, consists in the administration of thymol, calomel, or filix mas. *Fasciolopsis buski* is best treated with thymol or oil of eucalyptus. The method of administration of these drugs will be found fully described in the sections of this article dealing with the treatment of cestode infections and with uncinariasis.

Pulmonary Distomatosis.—This condition, also known as paragonimiasis, is caused by the invasion of the lung by the fluke known as *Paragonimus westermani*, and is characterized by repeated attacks of hemoptysis, irregular fever, emaciation, and the presence of the eggs of the parasite in the sputum.

Etiology and Pathology.—*Paragonimus westermani*, Kerbert, 1878, is a flat worm, brownish red or gray in color, and measures 7.5 to 16 mm. in length, 4 to 8 mm. in breadth, and 2 to 5 mm. in thickness. The eggs are oval in shape, light brown or yellow in color, and measure from 0.08 to 0.1 mm. long by 0.045 to 0.075 mm. broad. There is a distinct operculum, and the ovum and yolk cells are well marked. The life history is unknown, but the eggs develop a miracidium in from four to eight weeks after reaching water, and it is probable that this stage enters some aquatic animal and then reaches man in food or drink. The parasite was first discovered in Bengal tigers, but it infests man in China, Corea, the Philippines, Japan, Formosa, and Sumatra. Several cases have been described in the United States. The pathological changes produced by this fluke may be very extensive. They have been found in the lungs, intestine, liver, pleura, brain, the mediastinum, diaphragm, and in the cervical and inguinal regions, and generally occur, two or more together,

lying within cysts in the invaded tissues. The lesions produced vary from a simple infiltration of the connective tissue of the organs, with the eggs of the parasites, to extensive abscess formation. The characteristic lesion is a thick-walled abscess containing within it degenerated tissue cells, the eggs of the parasite, and one or more of the flukes. Such lesions are common in the invaded organs, and are especially numerous in the lungs and liver. In time the typical cystic lesion results, the walls of the cyst being smooth, and the contents consisting of thick blood-stained material, containing the eggs of the parasite or the parasites.

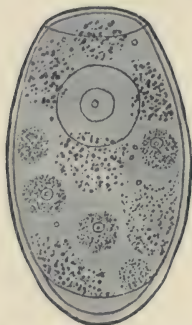
Treatment.—The treatment of this infection is unsatisfactory. No specific has been found that will kill the parasites in the tissues, and the most that can be done is to treat the symptoms as they arise. Musgrave

recommends the use of iodide of potassium, and this drug is certainly worthy of a more extended trial than it has yet received. Various inhalation methods have been devised, with the expectation of killing the flukes while still in the lungs; but, without exception, they have all proved useless. Surgical measures may prove of service in those cases in which the exact location of the parasite can be determined, as in brain infection, but no means has yet been discovered which will remove the parasites from the lungs or other viscera.

The principal symptoms to be combated are the anemia, which results from the frequent attacks of hemoptysis, and the cough, which is often most weakening to the patient.

The latter may be helped by antispas-

FIG. 9



Egg of *Paragonimus westermani*.
× 1000. (Katsurada.)

modics, and I have found that the combination of heroin and syrup of wild cherry is an efficient cough mixture in these infections. Hemorrhage, if severe, should be treated by opium and purgation; in some instances the administration of digitalis will be found most serviceable. The patient should have absolute quiet, and should be told to rest upon the affected side if the physical signs have been such as to make a diagnosis of the location of the infection possible. At any rate, he should be kept quiet in a reclining position. Ergot and any other drug which raises the blood pressure should be avoided; alcohol is never indicated, even though collapse, which is rare in these cases, be present. The cough can be controlled by opium better than by any other drug, but owing to the danger of establishing a habit, this drug should never be used for the cough unless hemorrhage be present. Tonics are always indicated, and some form of iron and arsenic should be administered, as anemia is almost invariably present. Basham's mixture and Fowler's solution are the best methods of administering iron and arsenic in these infections. The patient should be removed from the endemic area if possible, and should have plenty of plain, nutritious food.

The *prophylaxis* consists in the avoidance of unboiled water and uncooked food in the endemic regions; the destruction of the animals known to harbor the parasite, as cats and dogs; the disinfection of the sputum of the infected individuals, and the proper disposal of sewage. It is doubtless true that this is a self-limited infection, and if the patient is not too heavily infected, and is removed from any chance of reinfection, the parasites will finally disappear and recovery ensue.

Hepatic Distomatosis.—Several flukes invade the liver of man and produce symptoms differing in character according to the type and severity of the infection, and the distribution of the parasites in organs other than the liver. The principal trematodes concerned in liver infections in man are *Fasciola hepatica*, *Opisthorchis felineus*, *Clonorchis sinensis*, *Clonorchis endemicus*, and *Dicrocoelium lanceatum*.

Etiology and Pathology.—*Fasciola hepatica*, Linnaeus, 1758, is normally a parasite of sheep, horses, cattle, goats, and other herbivora, but has often been found in man. Its distribution is world-wide. It is a flat worm, measuring 18 to 30 mm. in length, and 5 to 13 mm. in breadth. The eggs are oval in shape, brownish yellow in color, and measure 0.13 to 0.14 mm. in length by 0.07 to 0.09 mm. in breadth, and have a well-defined lid or operculum. The miracidium develops after the eggs have been in water for several weeks, escapes from the egg, and enters the body of a snail, where a form known as the *Redia* is developed. The latter form produces the *Cercariæ*, which leave the snail host, attach themselves to grass or weeds, encyst, and reach the final host, generally sheep, by being eaten with the vegetation upon which they are encysted. The infection of man appears to be purely accidental. The parasite generally infests the liver, but has been found in the lungs, in abscesses, in the veins, and even in the eye. The lesions produced by it and its eggs are connective-tissue proliferation, abscess formation, and eventually cystic infiltration of the liver, and dilatation of the bile ducts.

Opisthorchis felineus, Rivolta, 1885, is normally a parasite of the cat, living in the bile ducts and gall-bladder; but it is said to occur commonly in man in some parts of Europe, especially Siberia. It is a lanceolate worm, measuring 8 to 18 mm. in length by 1.25 to 1.5 mm. in breadth. The eggs are oval, brownish yellow in color, and measure 25μ to 30μ in length by 10μ to 15μ in breadth. There is a well-defined operculum, and the miracidium is already formed when the egg is deposited. The life history and mode of transmission are unknown. These parasites cause catarrhal cholangitis and thickening and cirrhosis of the walls of the bile ducts. They may also occur in the intestine and pancreas.

Clonorchis sinensis, Cobbold, 1875, is the well-known Asiatic liver fluke, and is found in China, Japan, the Philippines, India, Formosa, and cases have been reported from almost every country, no less than thirty having been found in the United States. The parasite is a long lanceolate fluke, measuring 10 to 20 mm. in length and 3 to 5 mm. in breadth. The eggs are peculiar in that the anterior end is narrow and has a brim-like projection marking the position of the operculum. The life history and mode of transmission are unknown. These flukes

produce very marked lesions when present in any number in man. The gall-bladder and bile ducts are the chief habitat of the flukes, but they have been found in the pancreas, the stomach, and the duodenum. They cause cirrhosis of the liver and gall-bladder, catarrhal cholangitis, obstruction and atrophy of the bile ducts, and in severe cases very marked atrophy of the liver.

Clonorchis endemicus, Baelz, 1883, is a liver fluke occurring in man in Japan. It is normally a parasite of cats, pigs, and dogs. It measures from 6 to 12 mm. in length by 1.88 to 2.5 mm. in breadth. The eggs have a distinct operculum, and measure 25μ long by 15μ broad. The life history and mode of transmission are unknown. These flukes produce hypertrophy of the liver and a form of chronic diarrhea.

FIG. 10



Egg of *Opisthorchis sinensis*.
(Katsurada.)

Dicrocoelium lanceatum, Stiles and Hassel, 1896, is a small fluke occurring in Europe, North and South America, Asia, and Africa. It is commonly called the lancet fluke, and measures 4 to 9 mm. in length by 2 to 2.4 mm. in breadth. The eggs are dark brown in color, and measure 38μ to 45μ in length by 20μ to 30μ in breadth. The operculum is well defined, and the

eggs contain a ciliated miracidium when deposited. The life history and mode of transmission are unknown. The pathogenesis of this fluke has not been proved.

Treatment.—There is no specific treatment for any form of hepatic distomatosis. In light infection spontaneous recovery may occur, but in cases in which the tissues are invaded by any number of flukes it is doubtful if recovery is possible. In those instances in which the infection is known to involve the bile ducts or the gall-bladder a laparotomy should be performed and the flukes removed from the ducts or bladder, or, as Katsurada recommends, pressed from the bile ducts into the intestine. It is probable that surgical measures may be more useful in this class of trematode infections than is generally thought, and as under present methods an exploratory laparotomy is practically devoid of danger, it is recommended that in all cases of infection with liver flukes in which the symptoms are serious and where a skilled operator can be obtained this procedure be adopted.

In infections with *Clonorchis sinensis* the administration of salol in doses of 0.325 to 0.65 gm. (gr. v to x) three times a day is said to be of distinct value. Symptoms are to be treated as they appear, and any secondary infections carefully searched for and properly treated. The patient should be removed, if possible, from the endemic area, should have plenty of nutritious food, and should avoid alcohol and excesses of every kind.

Prophylaxis consists in the disinfection of the feces, preferable with carbolic acid, 5 per cent., or by heat, and the destruction of animals, as cats and dogs, which harbor the parasites. All drinking water should

be boiled, and the use of raw fruits or vegetables should be avoided. The use of human sewage for fertilizing purposes should be forbidden in the endemic regions.

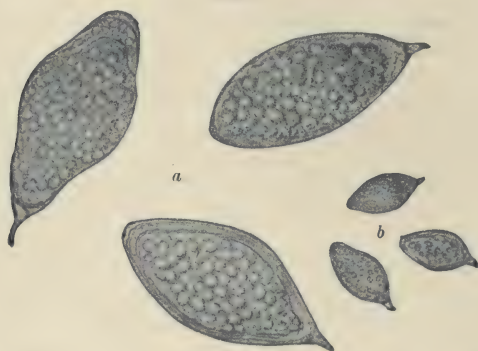
Venal Distomatosis.—This name is applied to trematode infections in which the flukes live within the bloodvessels, generally the portal vein. The eggs are discharged into the capillaries, and reach certain tissues where symptoms are produced by the lesions caused by the irritative action of the multitudes of eggs. A peculiarity of the flukes concerned in venal distomatosis is that they are all sexually differentiated, unlike the other flukes infecting man, which are all hermaphroditic. The term “bilharzial disease” is commonly applied to infection with these flukes, and as they all belong to the genus *Schistosomum*, the general term “Schistosomiasis” is frequently used in referring to them. There are three species of trematodes which invade the bloodvessels of man—*Schistosomum hæmatobium*, producing urinary schistosomiasis; *Schistosomum mansoni*, producing intestinal schistosomiasis; and *Schistosomum japonicum*, producing the so-called “Katayama disease” of Japan.

Urinary Schistosomiasis.—This form of schistosomum infection is characterized clinically by cystitis, hemorrhage from the bladder, and by the occurrence in the urine of the eggs of *Schistosomum hæmatobium*.

Etiology and Pathology.—*Schistosomum hæmatobium*, Bilharz, 1852, was first observed in the portal vein of man by Bilharz, in 1852. The parasite occurs in Africa, India, Syria, Arabia, and Persia, and is sexually differentiated. The male measures from 11 to 15 mm. in length and is 1 mm. wide. It is flat in shape and is distinguished by having a so-called “gynecophoric canal,” formed by the infolding of the lateral edges of the worm, and in which the female worm lives. The latter is longer and more slender than the male worm, measuring 18 to 20 mm. in length by 0.25 mm. in breadth. The eggs are a long oval in shape, measuring 0.11 to 0.2 mm. in length and 0.05 to 0.07 mm. in breadth. They are yellowish in color, semitransparent, and characterized by having a sharp terminal spine at the posterior end. An operculum is absent, and they contain an embryo when voided in the urine. The life history of the parasite has not been thoroughly worked out, but to Looss, of Cairo, we owe what we know concerning it. He considers man the intermediate host of the worm, whom it infects by entering through the skin from water used in bathing. The worms work their way through the tissues to the liver, where the immature males and females may be found in the portal system. When sexually mature the females are fertilized in the portal vein, and the worms are then carried to the bloodvessels of the bladder, the eggs being deposited in the veins of that organ, later penetrating the bladder wall, and reaching the lumen of that organ, as shown by their appearance in the urine. The intestinal walls, especially those of the rectum, may also be invaded; and the eggs may appear in the feces. The pathological lesions are produced by the irritation caused by the masses of eggs in the tissues, and may be hypertrophic or atrophic in character. The changes are most frequently observed in the bladder, but may occur in any organ invaded by the eggs. In the

bladder papillomatous masses are formed in the mucous membrane, which ulcerate, and thus produce the hemorrhage so frequently observed in this infection, and the consequent passage of bloody urine. The eggs excite a marked round-cell infiltration, which gives rise to thickening of the mucous membrane and a great increase in the amount of connective tissue, leading eventually to atrophy of the organ or to marked thickening of the bladder walls. Abscesses may be produced, or sinuses formed between the bladder and the abdominal wall, or the urethra, prostate, or kidneys may become involved.

FIG. 11

Eggs of *Schistosomum hæmatobium* from the urine. (After Simon.)

Treatment.—There is no specific for infections with this parasite, the treatment being largely symptomatic. Male fern has borne a reputation for years as being a specific in this disease, but it does not destroy the parasites, although it appears to modify the symptoms and to markedly reduce the number of eggs voided in the urine. It is given in doses of 1 gm. (gr. xv) three times a day, but its administration should be watched, and the appearance of vertigo, tinnitus aurium, or vomiting indicates that the drug should be stopped at once. It should not be given for more than a few days at a time. The fluidextract of the drug may be given in doses of 0.5 c.c. three times a day, and is said to be better borne than the oleoresin. Urotropin, in doses of 0.325 gm. (gr. v), three times a day, is useful, as is salol in the same dose. The administration of boracic acid in doses of 0.325 gm. (gr. v), three times a day, is most valuable in preventing secondary infections in the bladder. Methylene blue has been vaunted as a specific, but while of some value, other drugs are as good and are free from the objections which may be urged against this one. If administered the dose is 0.20 gm. (gr. iij), three times a day, given in capsules.

The use of injections for the purpose of killing the worms has not been attended with success. For this purpose injections of sulphuretted hydrogen or carbon dioxide have been advocated, but they are of no value, and should not be used.

The cystitis should be treated by washing out the bladder with a 1 to 1000 solution of silver nitrate, or quinine may be used in a 4 per cent. solution. The administration of urotropin or boracic acid in the doses mentioned will be found most valuable in controlling the cystitis, or the bladder may be washed out with a warm boracic-acid solution, 4 per cent. If neither the internal administration of these drugs or the washing out of the bladder controls the symptoms it is considered best by some authorities to open and drain the bladder. If calculi be present they should be removed by lithotrity, and if fistulas have formed they should be dissected out, as in the case of fistulas due to other causes. The hemorrhage may sometimes be so severe as to require treatment, and if so, adrenalin may be used in a bladder injection, or the bladder may be washed out with hot boracic-acid solution or a weak solution of perchloride of iron. Lithotomy should not be performed if it can be avoided, but perineal drainage has been efficient in a few cases, although the results are generally disappointing. If the rectum is involved the treatment is the same as that of intestinal schistosomiasis, which is considered under the appropriate heading. The treatment of dysenteric symptoms will be found considered under the section dealing with the Dysenteries.

The general treatment consists in the avoidance of excesses of all kinds, rest in bed whenever the symptoms are troublesome, plenty of plain nourishing food, and the avoidance of reinfection. Tonics, as iron, arsenic, strychnine, and cod-liver oil, are useful, and the patient should avoid the use of any form of alcohol. If possible the patient should be removed from the endemic area and given a change of climate. He should be encouraged to drink a large quantity of water, which should be boiled or distilled in regions where infection is probable.

The *prophylaxis* consists in the use of boiled water and cooked food, the disinfection of the patient's urine and feces with carbolic acid, 1 to 20, or formalin, 1 to 60, and avoidance of bathing in public baths or pools, or in water which might in any way become infected. The patient should be warned that under no circumstances should he void his urine into water which may be used for bathing or drinking while in infected districts; the use of human sewage for fertilizing purposes should be prohibited.

Intestinal Schistosomiasis.—Infection with *Schistosomum mansoni* is known as intestinal schistosomiasis, or intestinal bilharziosis, and is characterized by dysenteric diarrhea, with or without fever, and the occurrence of the eggs of the parasite in the feces.

Etiology and Pathology.—*Schistosomum mansoni*, Manson, 1907, was for many years confused with *Schistosomum hæmatobium*, but in 1907 it was differentiated from the latter by Sambon, and later da Silva described both the male and female worm. It occurs in Africa, Central and South America, and the West Indies. The male worm measures 12 mm. in length and 0.44 mm. in breadth; the female, 14.5 mm. in length and 0.168 mm. in breadth. The eggs measure 146μ by 62μ , and are differentiated from those of *S. hæmatobium* by having a lateral instead of a

terminal spine. The life history and mode of transmission are unknown. The lesions are due to the irritation caused by the masses of eggs which are deposited in the intestinal capillaries, the parent worms reaching the capillaries from the portal vein. The eggs give rise to round-cell infiltration in the intestinal mucous membrane, with the formation of papillomatous growths, especially in the rectum. Eventually the mucous membrane becomes greatly hypertrophied, the intestinal coats are thickened, and even the peritoneum may become involved. Ulceration may occur, giving rise to severe dysenteric symptoms, while fistulas may form in the tissues of the infected regions, giving rise to all the symptoms common to a chronic suppurating process. The liver and lungs may be the seat of abscess formation, and the occurrence of a form of chronic fibroid pneumonia is not infrequently observed.

Treatment.—Treatment, in the absence of a specific, is unsatisfactory. The most that we can hope to do is to relieve the symptoms, and by surgical measures to limit the extent of the infection. The administration of male fern in the manner already described for urinary schistosomiasis is recommended by some authorities, but the results are not encouraging. The use of rectal injections of quinine and sodium hypochlorite, 10 to 1000, are of some benefit, and sedative enemas of starch and opium are useful in allaying irritation and pain.

The rectal tumors formed by the invasion of the tissue by the eggs of the parasite should be removed with the knife, and if the rectum is badly involved a Whitehead operation may be performed, although it is doubtful if the results warrant the procedure. If a distinct tumor can be palpated in the intestine, enterotomy should be performed and the affected region of the gut removed.

The patient should avoid stimulants and excesses of all kinds. The food should be plain and nutritious, and care should be taken to keep the bowels open by a gentle laxative, cascara sagrada being the best drug for this purpose. When the symptoms are acute, rest in bed should be insisted upon by the physician.

The *prophylaxis* consists in those measures already recommended in discussing infection with *Schistosomum hæmatobium*.

Katayama Disease.—A disease caused by *Schistosomum japonicum*, and called "katayama disease," occurs in Japan, and is characterized by enlargement of the liver and spleen, anemia, dysenteric symptoms, and the presence of the eggs of the parasite in the feces.

Etiology and Pathology.—The cause of this disease, *Schistosomum japonicum*, Katsurada, 1904, was first described by Katsurada. It is sometimes called *Schistosomum cattoi*, but this name is incorrect. Like all of the flukes invading the blood of man this one is sexually differentiated. It also occurs in the domestic cat. The male measures 6.5 to 12 mm. in length by 0.53 mm. in breadth; the female, 8 to 12 mm. in length by 0.4 mm. in breadth. The eggs measure 60 μ to 90 μ in length and 28 μ to 50 μ in breadth, and have neither operculum nor spine. The life history and mode of transmission are unknown. Infection is presumed to occur through infected food or drink. The pathological lesions

produced by this parasite are numerous and important. Thus peritonitis, cirrhosis of the liver, hypertrophy of the spleen, and thickening and ulceration of the intestine are all common lesions observed in infections with the Asiatic blood fluke. The eggs are found in all of the organs showing pathological lesions, and have been demonstrated in the mesenteric glands. The brain may be invaded, as may every other organ in the body.

Treatment.—There is no specific for infections with this worm, and treatment is largely symptomatic, following the same lines laid down in the treatment of infections with *Schistosomum mansoni*. Where the disease can be localized, operative measures may give relief, and should be resorted to in suitable cases.

THE TREATMENT OF CESTODE INFECTIONS.

While not dangerous to life, as a rule, infection with cestodes or tapeworms are most important, both because of their prevalence and because of the ill health which they often occasion. Numerous cestodes have been found to live as parasites within man, but only a comparatively small number demand consideration, for while the others are of importance in the rare instance in which they occur, they are so very infrequent that their consideration will not be attempted at this time. Furthermore, the treatment of these rare infections is the same as for the commonly observed tapeworms. There are but four species of tapeworm which are of pathological importance sufficient to merit their description here. These are: *Dibothriocephalus latus*, *Tænia saginata*, *Tænia solium*, and *Hymenolepis nana*. Of these, *Tænia saginata* is the most common, while the most severe symptoms are caused by *Tænia solium*. In some localities *Hymenolepis nana* occurs in large numbers, and may cause severe and dangerous symptoms.

Etiology and Pathology.—*Dibothriocephalus latus*, Linnaeus, 1758, also known as the broad tapeworm, occurs in man, dogs, and cats in the adult form, and as a larva in the muscles of fresh-water fish, as the pike, perch, and salmon. The worm measures from 2 to 10 meters in length, the greatest breadth being 20 mm., and contains from 3000 to over 4000 segments, which are broader than they are long. The eggs measure 65μ to 70μ in length and 45μ in breadth, and have a distinct operculum. The worm produces a severe and even pernicious anemia, with fever, and for this reason infections with it are serious and should be promptly treated. The anemia and other symptoms are due to a toxin, according to recent observations. Infection of man occurs through eating raw or underdone fish.

Tænia saginata, Goeze, 1782, or the unarmed beef tapeworm, occurs as an adult only in man and as a cysticercus in cattle. It has a world-wide distribution. The worm measures 4 to 8 to 10 meters in length, and may contain as many as 1000 segments. The eggs measure from 30μ to 40μ in length by 20μ to 30μ in breadth, the shell being radially striated. The symptoms produced by this worm are less severe than those

caused by other common tapeworms, anemia being the most prominent. Infection of man occurs through eating raw or partly cooked beef, the tongues of cattle being especially liable to harbor the cysticeroid stage of development.

Tænia solium, Linnaeus, 1758, or the pork tapeworm, occurs as an adult only in man, while the larval form, known as *Cysticercus cellulosæ*, is usually found in hogs. It has a world-wide distribution. The worm measures from 2 to 6 to 8 meters in length, and may have from 700 to 900 segments. The eggs measure from 30μ to 36μ in length, and so closely resemble those of *Tænia saginata* that they are distinguished with difficulty. The chief danger attending infection with this worm is the occurrence of cysticeroid disease. The infection reaches man through eating raw or underdone pork, and is transmitted from person to person by the segments.

Hymenolepis nana, Siebold, 1852, or the "dwarf tapeworm," is the smallest tapeworm occurring in man, measuring only from 5 to 45 mm. in length by 0.5 to 0.9 mm. in breadth, and contains from 100 to 200 segments. It is the most common of all tapeworms in some localities, and a form

FIG. 12



Head and strobila of *Hymenolepis nana*, enlarged. (Leuckart.)

FIG. 13



Egg of *Hymenolepis nana* as seen in fresh feces, enlarged. (Ransom, from Stiles.)

closely resembling if not identical with it occurs in rats and mice, from which the infection of man is supposed to be derived through contaminated food. The eggs are peculiar, having two membranes, the outer membrane being 30μ to 60μ in diameter, the inner 15μ to 35μ in diameter, having delicate filaments, which extend from each end of the inner membrane, and may be demonstrated in the space between the two membranes. Autoinfection and transmission directly from person to person may occur.

Treatment.—The treatment of tapeworm infection, if properly carried out, is most satisfactory, and we may almost claim that in *male fern* we

possess a specific for these parasites. The treatment should be divided into a preparatory and a remedial period, and unless the patient be carefully prepared for the administration of the anthelmintic it is useless to attempt the removal of the worm.

As regards the time for treatment, it may be said that the earlier it is instituted after the discovery of the infection the better, and especially is this true in infections with *Tænia solium* and *Dibothriocephalus latus*, for the danger of cysticeroid disease in infections with the former, and of severe and even fatal anemia, caused by the latter, render these parasites most dangerous ones. However, if severe symptoms are already present, and the patient is greatly weakened, it is better to wait until the general condition can be improved by tonics and attention to the diet. If improvement is not possible in this way the anthelmintic should be given at once. When pregnancy exists it is best to wait until after the birth of the child, as abortion may follow the use of an anthelmintic.

Preparatory Treatment.—The object of the preparatory treatment is to empty and clean the intestine so that the anthelmintic may be brought into contact with the parasite. It should be remembered that unless the head of the worm is gotten rid of the infection will continue, new segments being produced, and it is necessary that the intestine be practically empty or the anthelmintic will not cause the worm to release its hold upon the mucous membrane.

For at least two days before the anthelmintic is administered the patient should be put upon light diet, consisting of milk, broths, eggs, and tea or coffee, and for the twenty-four hours preceding the administration it is best to give no food at all, beyond a little beef tea, or milk in small quantities. A saline cathartic, preferably magnesium sulphate, should be administered each morning of the preparatory treatment, and the morning of the remedial treatment a large enema of soap and water should be given, and the patient given nothing to eat but a small piece of milk toast or a half-glass of milk.

Remedial Treatment.—During, and for some hours after, the administration of the anthelmintic chosen, the patient should remain quiet in bed or upon a reclining chair in order to prevent vomiting and nausea, which are frequent if the patient be allowed to get about. As an anthelmintic I have found that male fern has given the best results in my hands, but the preparation used should be fresh, and it is best given in the form of the oleoresin.

The extract of male fern may be given in capsules in doses of 0.325 gm. (m̄v), 4 to 8 of these capsules being given at once, but I have used in preference the oleoresin in gelatin capsules of 1 gm. each (gr. xv), from 2 to 7 of the capsules being given at intervals of ten minutes. For a robust adult from 6 to 7 gm. of the oleoresin may be given, with good results, but in women and children and in the debilitated the use of this drug should be attended with caution, as it sometimes gives rise to serious toxic symptoms, as syncope, convulsions, intense vertigo, severe vomiting, and collapse. Death has followed the administration of large doses of male fern in the debilitated. The dose, then, should be graduated to the

strength, age, and sex of the patient, as much being used as is deemed possible in the particular case under treatment. The capsules should be coated with keratin in order that they may pass through the stomach without dissolving, thus allowing the drug to become liberated in the intestine in the best form to influence the worm.

One hour after the last capsule has been taken the patient should be given 30 gm. (1 ounce) of magnesium sulphate and the resulting movements passed into warm water, extreme care being taken not to pull upon the worm during its passage or to subject it to cold, as either accident may result in the separation of the segments and the retention of the head of the parasite within the bowel. The physician should make a minute examination of the parasite, which is best done by floating it out upon the surface of warm water, and unless the head is found the administration of the anthelmintic should be repeated in a few days. It is best to repeat the drug as soon as possible, as it is probable that the worm will be weakened by the previous administration, and that a second one, repeated within a short interval, will result in success.

While male fern has given satisfactory results in the hands of most physicians, there are other remedies used for the expulsion of tapeworms which bear as good a reputation, and are sometimes to be preferred, especially if the patient be debilitated, or if pregnancy be present, and it is necessary to administer an anthelmintic. Of these I believe that the decorticated seed of the pumpkin is most useful, and it is especially valuable in the case of children. The preparatory treatment should be the same, and the seeds may be given in an emulsion, from 30 to 120 gm. (℥j to iv) being crushed in warm water, strained, and a little simple syrup added, or they may be eaten.

The drug known as *cusso*, or *kousso*, is recommended highly by numerous authorities. I have never used it, but Tyson considers it the most efficient anthelmintic that he has used. It should be fresh, and from 20 gm. (℥v) to 30 gm. (℥viiss) should be administered as an infusion in water or given in divided doses in wine. The preparatory treatment is the same as for male fern, but it is seldom necessary to administer a cathartic afterward. This drug should never be administered in pregnancy.

The bark of fresh *pomegranate root* has some reputation as an anthelmintic, but it is inferior to male fern or pumpkin seed. Its alkaloid, *pelletierine*, is probably superior to the crude bark, and is widely used in Europe. While the bark may be given in the form of an infusion it is preferable to administer it in the form of the fluidextract, in doses of 2 to 6 c.c., as it is much more pleasant to take in this form. The alkaloid is given in doses varying from 0.3 to 1.3 gm. (gr. v to xx). Both the extract and the alkaloid sometimes cause vomiting and syncope, and both should be used with caution in the young or the debilitated. The preparatory treatment consists in giving a saline cathartic the night before the drug is to be administered and an enema the same morning. One hour after the administration a full dose of magnesium sulphate should be given.

Whatever drug be selected as an anthelmintic in tapeworm infection it is absolutely necessary that the preparatory treatment be rigidly carried out, or in the vast majority of instances the result will be failure in securing the head of the worm. It is probable that most of the unsatisfactory results which have been obtained with any one of the drugs mentioned have been due to the lack of proper attention to the preparatory treatment. It is often exceedingly difficult to secure the worm after the administration of only one course of treatment, and unless the preparatory treatment be thorough I believe that a single course of treatment will not be successful except in rare instances. The patient should be impressed with the fact that in order to be successful in the treatment of these infections a rigid preparatory treatment must be followed, although it will prove very disagreeable, and that unless he is willing to submit to such treatment it is useless to administer the anthelmintic.

Of the other drugs which have been recommended in the treatment of cestode infection, as santonin, thymol, oil of turpentine, and chloroform, it may be said that they are all inefficient, and should not be used for this purpose. The same may be said of the various worm lozenges and proprietary remedies for tapeworms with which the market is flooded; most of them are inert, and those that are not are dangerous. The treatment of *cysticercoid disease* is purely surgical, and will not be considered in this contribution.

THE TREATMENT OF NEMATODE INFECTIONS.

The nematodes, or round worms, cause some very important infections in man, one of which, uncinariasis, is of wide distribution and of great economical importance. The principal worms belonging to this class which infest man are: *Anchylostoma duodenale*, *Necator americanus*, *Filaria bancrofti*, *Trichinella spiralis*, *Strongyloides stercoralis*, *Ascaris lumbricoides*, and *Oxyuris vermicularis*.

Treatment of Uncinariasis.—Uncinariasis, or hookworm disease, as it is commonly called, is caused by *Anchylostoma duodenale* and *Necator americanus*, and in many localities is of vast importance both from an economical and public health standpoint. To Stiles we owe the differentiation of the species now known as *Necator americanus*, and for the demonstration that infection with this worm is very common in our Southern States, while to Ashford we owe the knowledge that infection with this worm is the cause of the severe anemia which at one time ravaged Porto Rico. To Ashford and King we owe the demonstration that it is possible to practically eradicate the infection from an entire country. The campaign of the latter observers against hookworm disease in Porto Rico will always remain an example of what intelligent and enthusiastic effort is capable of in dealing with widespread parasitic infections.

Etiology and Pathology.—*Anchylostoma duodenale*, Dubini, 1843, or *Uncinaria duodenalis*, as it is sometimes called, occurs in Europe, Asia,

Africa, the Philippine Islands, Australia, and, as imported cases, in the United States. The worms measure from 7 to 18 mm. in length, the eggs from 64μ to 72μ long by 36μ to 40μ wide. The distinguishing marks separating it from *Necator americanus* are the armature of the mouth, the structure of the bursa of the male, and the position of the vulva in the female. The mouth contains two pairs of ventral curved teeth and one pair of dorsal teeth. There is practically no dorsomedian tooth, but a pair of ventral lancets. The dorsal ray of the bursa in the male is divided into two branches, and each branch into three pointed extremities. The vulva in the female is situated in the caudal half of the body.

Necator americanus, Stiles, 1902, was probably imported into America from Africa, but it is now the common species encountered in this country. It is found also in Porto Rico, China, the Philippines, and in other countries as imported cases. The worms measure from 7 to 11 mm. in length; the eggs, 52μ to 61μ in length and 32μ to 38μ in breadth. The armature of the mouth consists of a dorsal and ventral pair of lips, a well-marked dorsomedian buccal tooth, and four pairs of lancets. The dorsal ray of the bursa in the male divides into two portions, and each portion subdivides into two pointed extremities. The vulva in the female is situated in the anterior half of the body instead of in the posterior half, as in *Anchylostoma duodenale*. Infection with these worms results in severe anemia, catarrhal conditions of the stomach and intestines, hemorrhage from the intestine, and atrophy of the mucous membrane of the jejunum and ileum. Infection of man occurs through the mouth or the skin, the latter method being probably the most common. Twenty-four hours after passing from the body in the feces the eggs are seen to contain a rhabditiform embryo, which undergoes certain changes, occupying a period of from five to ten days, after which it is ready to infect man, which it may do by being swallowed in food or drink, or by dirty hands; or the larvæ may penetrate the skin and reach the intestine in the interesting manner first worked out by Looss, passing with the blood from the skin through the heart and finally reaching the lungs, where the embryos pass up the trachea and larynx, and down the esophagus to the stomach and intestine.

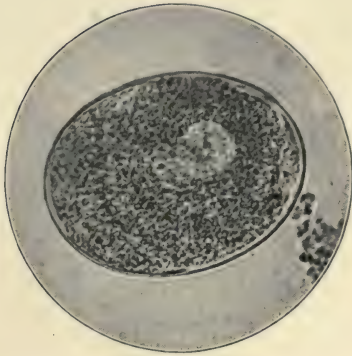
Treatment.—A great many drugs have been advocated from time to time in the treatment of uncinariasis, but few are of real value, thymol, oil of eucalyptus, beta-naphthol, and male fern being the only ones deserving of consideration.

Here, as in tapeworm infections, the preparatory treatment is of great importance, and should always be insisted upon. It consists in keeping the patient upon light diet for twenty-four hours before the administration of the drug selected, and emptying the bowel by a full dose of magnesium or some other reliable cathartic the evening before the treatment is commenced. The morning of the treatment an enema of soap and water should be administered and the patient allowed only a little soft toast and a small cup of coffee or tea.

Thymol was introduced by Bozzolo in 1880, and possesses a well-deserved reputation as a specific in this infection. It is a drug which

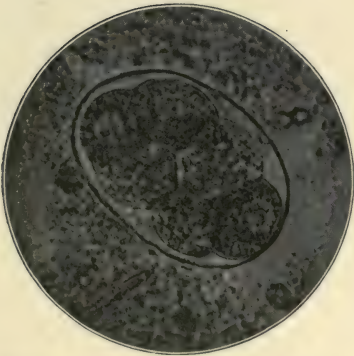
PLATE VI

FIG. 1



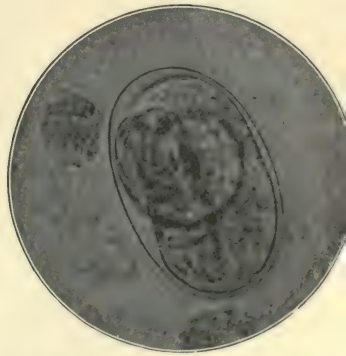
Unsegmented Egg of *Necator Americanus*

FIG. 2



Segmented Egg of *Necator Americanus*.

FIG. 3



Eggs of *Necator Americanus* containing E

should be used with caution, however, as it has produced severe toxic symptoms and even death. The symptoms indicating poisoning are vertigo, vomiting, syncope, convulsions, delirium, and collapse, while the urine may be colored a dark green or greenish brown. The treatment of poisoning with this drug consists in the administration of stimulants, as nitroglycerin, strychnine, or atropine, and the washing out of the stomach and intestine with salt solution and the use of magnesium sulphate to secure catharsis. Alcohol should never be used as a stimulant in poisoning with thymol.

The contraindications to the use of this drug are extreme weakness and debility, gastritis, valvular disease of the heart, nephritis, dysentery or severe diarrhea, and marked anemia. It should not be given in pregnancy.

The patient having been prepared as stated, from two to three capsules, each containing from 0.65 to 2 gm. (gr. x to xxx) of thymol are given at intervals of one hour. If the bowels do not move within four to five hours a purge, preferably magnesium sulphate, should be administered. This method of administration of the drug will result in the removal of most but not all of the worms, and the feces should be carefully examined after a week has passed, and if ova are found the treatment should be repeated. It is the rule, rather than the exception, to have to give a second course of treatment before the worms are all killed, and it is generally necessary to administer three or four such treatments unless the infection is a light one, in which case one treatment may be sufficient. The treatment should not be repeated more than once a week, and never if the first administration has been followed by alarming symptoms.

Ashford and King, who have probably had the largest experience of any modern physicians in the treatment of uncinariasis, recommend 0.5 gm. (gr. viiss) for children under five years of age; 1 gm. (gr. xv) for children between five and ten years; 2 gm. (gr. xxx) between ten and fifteen years; 3 gm. (gr. xlv) between fifteen and twenty years; 4 gm. (gr. lx) between twenty and sixty years and 2 or 3 gm. (gr. xxx to xlv) after sixty years of age. The dose of the drug should always be regulated according to the strength and age of the patient. The authors quoted have drawn their deductions from their experience in the administration of over 12,000 doses of thymol, and they consider that the danger attending its use has been greatly exaggerated, although they mention many contraindications to its use.

During the administration of thymol the patient should be cautioned against taking alcohol or any oil, as thymol is soluble in these, and the administration of them would cause the absorption of too much of the drug. Under ordinary conditions thymol is not very soluble in the intestine, and the object of the treatment is to bring the drug into contact with the worms without allowing much of it to be absorbed, so that anything which renders it soluble defeats the object of the treatment and renders the patient liable to poisoning by the drug. Other substances in which thymol is soluble and which should not be given are ether, chloroform, oil of turpentine, and glycerin. In case of need, stimulants should

be administered by the hypodermic syringe, and alcohol and ether should not be used.

Where the patient for any reason is unable to take the large doses of thymol recommended, small doses may be administered repeatedly, with good results, a few worms being expelled each time until they are all removed.

Oil of eucalyptus has displaced thymol in some localities as a remedy for hookworm infection, as it is said to be just as efficient and less dangerous. I have never used it, but it is doubtless a valuable remedy. The following formula is recommended by many who have used it:

R—Olei eucalypti	2.00	(℥ xxx)
Chloroformi	3.00	(℥ xlv)
Olei ricini	30.00	(f ʒj)

One-half of this mixture is given early in the morning and the remaining half thirty minutes later. The stomach should be empty at the time of administration. This dose generally has to be repeated for several successive days in order to get rid of all of the worms.

Beta-naphthol is strongly recommended by Bentley, who has used it in thousands of cases. The drug is administered in capsule in the same manner as is thymol, 1 gm. (gr. xv) being given every two hours until two or three doses are taken. Manson states that this drug is just as efficient as thymol, and is less unpleasant and dangerous. It would appear to deserve a more extended use in the treatment of uncinariasis in this country.

Male fern has been used extensively in treatment, with good results, but it is just as unpleasant to take, and nearly as dangerous as is thymol, while the results cannot be said to be as good. If used the patient should be prepared as already described, and 1 gm. (gr. xv) of the oleoresin in capsule should be given at intervals of half an hour, until from three to four capsules have been taken, after which a saline purge should be administered.

The treatment of convalescence from hookworm disease consists mainly in the use of blood tonics, as iron and arsenic, plenty of plain nutritious food, and if possible a change of climate. Blaud's pill, Basham's mixture, and Fowler's solution are all good preparations to use to build up the blood and to stimulate the appetite. The bowels should be kept open, and gentle outdoor exercise should be insisted upon.

The prophylaxis of uncinariasis is most important, but can only be touched upon here on account of lack of space. It consists essentially in the proper disposal of sewage and in personal cleanliness. Unfortunately in regions in which the hookworm is prevalent the population is largely of urban type, and the habit of defecation anywhere and everywhere is very common; and until this practice can be stopped the prophylaxis of uncinariasis will not be thoroughly effective. The keynote of prevention is the disposal of all fecal material in well-constructed privies or sewage systems.

PLATE VII



Section through Intestine showing *Necator Americanus* attached to the Mucous Membrane.

In infected regions shoes should be worn in order to avoid the penetration of the larvæ through the skin, evidenced by the occurrence of "ground itch," and all drinking water should be boiled or otherwise sterilized. Frequent cleansing of the hands, especially before eating, will prevent a large amount of infection in those whose duties bring them into contact with the soil.

The pernicious custom of using human feces for fertilization should be forbidden in any region where uncinariasis exists.

THE TREATMENT OF FILARIAL INFECTIONS.

Although many species of filaria have been found infesting man, the only one of great importance from a pathological standpoint is *Filaria bancrofti*, the cause of serious pathological conditions in the tropics and subtropics. This is a common species, and is transmitted from man to man by mosquitoes, the parasites passing a portion of their life cycle within these insects, the embryonic form undergoing development in the mosquito and becoming the adult in man. Thousands of the embryonic forms are produced by the adults within man and appear in the peripheral blood, the time of their appearance in this fluid being periodical. The embryonic form of *Filaria bancrofti* is called *Microfilaria nocturna* because of its appearance in the blood during the night. The embryos never produce any symptoms or lesions of disease, nor do the adults, except accidentally, by obstruction to the lymphatic channels. The diagnosis of infection rests upon the demonstration of the microfilariae in the peripheral blood.

Etiology and Pathology.—*Filaria bancrofti*, Cobbold, 1877, is sexually differentiated, the male measuring 38.5 mm. in length by 0.12 mm. in breadth; the female, 76 to 100 mm. in length and 0.185 in breadth. The microfilariae or embryonic forms, known as *Microfilaria nocturna*, Manson, 1891, measure 0.3 mm. by 0.008 mm., as a rule, and are enclosed in a sheath, within which they are freely movable. They occur in the blood at night in large numbers, and have active lashing movements, but do not progress while contained within the sheath. After reaching the stomach of the mosquito the sheath is lost and the embryos emigrate to the muscles of the thorax, where they develop and eventually enter the proboscis and reach man, when the mosquito bites. In 1906 Ashburn and the writer described a filarial embryo occurring in the Philippine Islands which we named *Microfilaria philippinensis*, and which differs from the embryos of *Filaria bancrofti* by having a tight sheath, active progressive motion while in the blood of man, and no periodicity as regards its appearance in the blood. This embryo was found first in the blood of a patient who had suffered from chyluria, so that this species may be pathogenic. The lesions produced by *Filaria bancrofti* are numerous, and depend upon the blocking of lymphatic vessels or irritation produced in the vessels by their presence.

Treatment.—The conditions most frequently produced by the adult filariae are abscesses, lymphangitis, varicose glands, lymph scrotum,

chyluria, elephantiasis, and orchitis. With the exception of lymphangitis, chyluria, and orchitis these are all surgical conditions, and are best treated by surgical measures, so that they will not be considered here. There is no known medicinal treatment which has the least effect upon either the adult parasites or upon the embryos.

The treatment of lymphangitis of filarial origin consists of rest, elevation of the affected part, the application of lead and opium wash, and free purgation, preferably with magnesium sulphate. Morphine may be given to relieve pain, but it will usually be found that the combination of phenacetin and caffeine will be sufficient for this purpose. Counterirritation may prove useful in some cases. After the acute symptoms have begun to subside, bandaging will often be found to give relief and to hasten recovery.

Chyluria is a frequent symptom of infection with filariæ, and the treatment cannot be said to be satisfactory. Internal medication is most unreliable, although various drugs have been recommended, such as gallic acid, benzoic acid, the tincture of the perchloride of iron, and sodium salicylate. Probably as good a drug to use as any is boracic acid, in dose of 0.325 gm. (gr. v), given three times a day, in capsule. The diet should be carefully regulated, the fats being restricted as much as possible, as well as stimulating, rich foods. The bowels should be kept open by laxatives if necessary, and rest in bed should be insisted upon. The irrigation of the bladder with silver-nitrate solution has been recommended, but its value is doubtful. The administration of thymol and methylene blue in the hope of some specific action upon the adult filariæ or the embryos has not met with success.

Filarial orchitis is best treated by rest in bed, elevation of the part, and the use of cold applications or the lead and opium wash. Light diet should be given and free purgation is indicated, the saline cathartics being used for this purpose.

THE TREATMENT OF INFECTIONS WITH *TRICHINELLA SPIRALIS*.

Infection with *Trichinella spiralis* is due to eating raw or imperfectly cooked pork infected with the embryos of this parasite. The infection is characterized by intestinal symptoms, and the development in the muscles of cysts containing the larva of the worm. The infections are often fatal, and severe outbreaks have occurred, involving hundreds of individuals.

Etiology and Pathology.—*Trichinella spiralis*, Owen, 1835, occurs in man, hogs, dogs, cats, and rats. Three forms of the worm occur in man, the adult, the embryo, and the encysted embryo. The adults are found in the duodenum and jejunum, the males measuring from 1.5 mm. to 1.6 mm. in length and 40μ in breadth; the females measure from 3 to 4 mm. in length by 60μ in breadth. The females after fertilization give birth to from 1200 to 1500 living embryos in the intestinal lymphatics. The embryos measure from 85μ to 100μ in length by 6μ

in breadth, and emigrate to the muscles, either through the lymph or the blood, where they become encysted, the cysts being just visible to the naked eye. Within these cysts the embryos may remain alive for years. Infection occurs by eating the flesh of hogs containing the encysted embryos. The pathological lesions consist in catarrhal inflammation of the intestine, especially the duodenum and jejunum, and the occurrence of the cysts containing the embryos, in the striated muscles of the body. The blood presents a marked eosinophilia.

Treatment.—Unless the infection be recognized before the birth of the embryos, treatment is practically useless, except as it relieves symptoms or strengthens the patient. If it is discovered that infected meat has been eaten the prompt administration of calomel or magnesium sulphate may result in getting rid of the worms, but very free purgation should be induced if we desire to accomplish this result. The stomach should be thoroughly washed out, using a stomach tube, if the opportunity for infection is discovered early enough. The administration of glycerin, as well as anthelmintics, as male fern, oil of eucalyptus, thymol and santonin has been recommended in the hope of removing the worms before the birth of the embryos. After the development of symptoms of gastro-intestinal irritation, treatment should be directed toward supporting the strength of the patient. The diarrhea should not be checked, as it may result in the evacuation of some of the worms. During the stage of muscular invasion the main indications are to relieve pain and to support the strength. Morphine is the best drug for the relief of pain, and the general treatment should be similar to that usually followed in continued fevers.

The prophylaxis consists in the use of thoroughly cooked pork, and in the proper housing and feeding of pigs.

THE TREATMENT OF INFECTIONS WITH *STRONGYLOIDES STERCORALIS*.

Infections with *Strongyloides stercoralis* are common in certain localities, and in Cochin China this worm is believed to be the cause of a form of chronic intermittent diarrhea. Cases have been observed in the United States, Europe, Asia, and Africa, and it is a comparatively frequent parasite in the Philippine Islands. I have observed no less than twenty-eight cases in soldiers of our army who contracted their infection in the Philippines. Its exact pathological significance is unknown, but I am satisfied that heavy infections cause severe diarrhea, characterized by intermittency.

Etiology and Pathology.—*Strongyloides stercoralis*, Bavay, 1876, exists in man in three forms, the adult, rhabditiform embryos, and the filariform embryo, while in addition there are free living stages of development. The adults are all females and produce their young by parthenogenesis. They measure 2.2 to 3 mm. in length by 34μ to 70μ in breadth. The eggs measure 50μ to 58μ by 30μ to 35μ , are segmented, and resemble

those of *Anchylostomes*. The eggs are not voided in the feces, except accidentally, but develop in man into the rhabditiform embryo, which measures from 200μ to 800μ in length by from 12μ to 20μ in breadth, the larger forms being discharged in the feces. They enter the body again as filariform larvæ after passing through a free living stage, but the free living generation may be omitted. Infection occurs through water or through the skin.

Treatment.—The treatment of infection with this worm is unsatisfactory, as they burrow into the mucous membrane of the intestine and thus render it difficult for any drug to reach them. Thymol administered as in uncinariasis is as efficient a drug as we possess, but it is often of little use. The use of other anthelmintics has not been attended with success.

The prophylaxis consists in boiling the drinking water in infected districts and wearing shoes or other protection to the feet. Personal cleanliness and the proper disposal of the feces should be observed as in infections with hookworms.

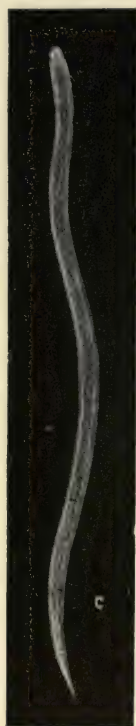
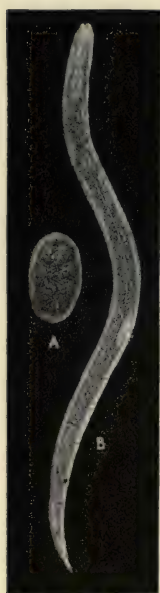
THE TREATMENT OF INFECTIONS WITH *ASCARIS LUMBRICOIDES*.

Infections with the common round worm are world-wide in distribution, and of much more importance than is generally believed. In the tropics and the subtropics *Ascaris lumbricoides* is often responsible for severe symptoms leading to the invalidism of the patient, and many of the obscure instances of breakdown in such regions are due, in no little measure, to severe infections with these worms. Fatal accidents sometimes attend the wanderings of an *ascaris*, instances of perforation of the bowel, suffocation, or abscess in the lungs having been recorded, so that even though the symptoms caused by the worm may be practically *nil* it is always best to administer treatment.

Etiology.—*Ascaris lumbricoides*, Linnaeus, 1758, in the adult form measures from 15 to 40 cm. in length, the male measuring from 15 to 25 cm. and the female from 20 to 40 cm. The width of the male is 3 mm. and of the female 5 mm. The eggs measure 50μ to 75μ in length by 35μ to 55μ in breadth, and are covered with a thick mammillated coat stained a bright yellow. Sometimes this coat is not present, when the eggs resemble certain stages in the development of the eggs of *Anchylostomes*. Infection of man may occur through contaminated water, food, or from soiled hands.

Treatment.—The specific for ascaris infections is *santonin*, the dose for a child being 0.01 gm. (gr. $\frac{1}{6}$) for each year of the age, and for an adult 0.20 gm. to 0.325 gm. (gr. iij to v). It is best to give three doses on three successive nights, combined with the same amount of calomel. This treatment should be repeated until the stools are found to be free from the ova. The parent, or the patient, should be warned concerning the effect of *santonin* upon vision, objects appearing yellow or blue; and also of the effect upon the urine, which is rendered greenish yellow in color if the reaction be acid, and red or purple if alkaline.

PLATE VIII



A, Egg of *Strongyloides Intestinalis*. B, Rhabditiform Embryo. C, Filariform Embryo.
(After Thayer.)

FIG. 14



Ascaris lumbricoides: A, female; B, male; C, egg; at *a* the female genital opening; *c*, the male spicules; *b*, the enlarged cephalic extremity, with its three lips. (After Perlo, from Ziegler.)

In the tropics and subtropics *santonin* should be thus taken at least every six months as a routine procedure, and such a practice will result in great benefit to the general health, for it is almost impossible to avoid infection in these regions.

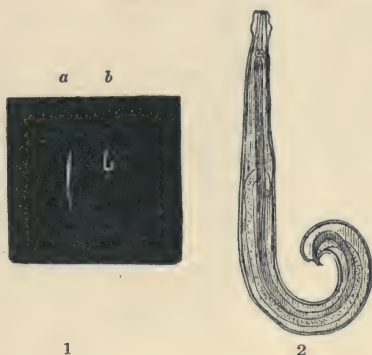
Among other drugs which have been recommended in *ascaris* infections may be mentioned equal parts of fluidextract of senna and *spigelia*, 2 to 4 c.c. (3ss to j) being administered at bedtime, and this I have found an excellent method of treating the infection in children. Oil of *chenopodium*, 0.15 to 0.5 gm. (ʒij to x), given before meals for two days and followed by a purge, is said to be efficacious; while the oil of *eucalyptus* has been of service in the hands of many practitioners.

Prophylaxis consists in boiling the drinking water and cooking all food in countries where human excrement is used for fertilizing purposes. Cleanliness of the hands and the proper disposal of sewage should be sufficient, with the use of boiled water and cooked food, to eradicate the infection from any locality in a short time.

THE TREATMENT OF INFECTIONS WITH *OXYURIS VERMICULARIS*.

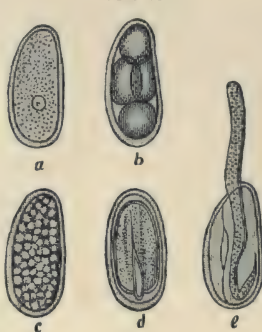
Infections with this worm, commonly known as "pinworm," or "seat-worm," are very frequently observed throughout the world, and by reason of the irritation caused by the worms and the production of diges-

FIG. 15



1. *Oxyuris vermicularis*: a, male; b, female; natural size. 2. Magnified. (After Heller, from Ziegler.)

FIG. 16



Eggs of *Oxyuris vermicularis*, showing division of the yolk and formation of the embryo. $\times 250$. (After Zenker and Heller.)

tive disturbances they are of considerable importance. This is especially true in the case of infants, in which they not infrequently produce severe symptoms.

Etiology.—*Oxyuris vermicularis*, Linnaeus, 1758, is more frequently observed in children than in adults, and in the early stages of its development lives within the small intestine, the females migrating to the large

intestine after fertilization. The male measures 3 to 5 mm. in length by 0.15 mm. in breadth; the female, 10 mm. in length by 0.6 mm. in breadth. The eggs measure 50μ to 52μ in length by 15μ to 25μ in breadth, and contain an embryo when voided in the feces. Infection occurs through the hands or infected food or drink. The female worms cause great irritation of the anus, and in scratching the worms may be crushed and the hands become infected, or contaminated bedclothing may give rise to infection.

Treatment.—The treatment of infection with this worm, while apparently simple, is much more complicated than appears at first sight. It should be remembered that not only must treatment remove the worms situated in the large intestine, but also the worms present in the small intestine at an earlier stage of development. It is thus necessary to combine with an anthelmintic some method of washing out and killing the worms situated low down in the colon and rectum. For the latter purpose there is nothing better than enemas of an infusion of quassia, given with the buttocks well elevated, and in such quantity that it will be possible to retain it for a few moments. This treatment should be repeated every night until the worms disappear. Other drugs which have been recommended for rectal injection are salt and water, lime water, salt and milk, glycerin, and perchloride of iron. The amount of fluid used for an injection should not exceed 500 c.c. (1 pint) in an adult, and 150 c.c. ($\frac{3}{4}$ v) in a child.

The internal treatment consists in the administration of santonin and calomel, or sulphur. Santonin, 0.05 to 0.1 gm. (gr. $\frac{3}{4}$ to iss), combined with the same amount of calomel, should be given for several days in succession, or sulphur, 0.2 gm. (gr. iij) in adults and 0.1 gm. (gr. iss) in children, may be given three times a day for several days.

The prophylaxis consists in the avoidance of infection or autoinfection from soiled hands, the proper disposal of feces, the use of boiled water and clean and well-cooked food, and the partial isolation of the infected individual, especially if a child. By this is meant that in no case should an infected individual sleep with another, and the bedclothing used by the infected should not be used by others without sterilization. The hands should be kept scrupulously clean, and children may be prevented from reinfesting themselves by wearing stout night-drawers, so made as to prevent them from infecting their hands by scratching, or the night-dress may be tied about the feet. Dishes which are apt to be handled by infected children should be sterilized before using, and care should be taken that the clothing of the infected individuals be disinfected before it is handled by the uninfected.

SYPHILIS

By WILLIAM S. GOTTHEIL, M.D.

A DUE appreciation of the varying conditions that render every case of sickness an individual problem to be handled as circumstances dictate is not incompatible with the formulation of broad, general lines of disease treatment and the laying down of fairly precise indications of the means at our disposal to combat any of the incidents that may occur during its course. However great and justifiable may be our opposition to that routine that tends to regulate medicine by rule of thumb, that brackets a remedy or an operative procedure with the name of a disease, that neglects the personal equation and surrounding circumstances, and that treats an illness and not a sick human being, the inevitable tendency of medicine on its scientific side is to standardization and schematization. It is true that the factors in each individual case are practically infinite, so that no two can be precisely alike; but these factors are not all of equal importance, and it is the essential ones that will determine the course to be pursued. And these latter are in most cases in so far similar or alike that it is possible to lay down general rules of treatment and establish a general standard of therapeutic action. It is fortunate that this is the case, for no one's experience can cover the whole ground, and we must rely on the observations of many others for the immense mass of facts upon which alone safe conclusions can be based.

These considerations are perhaps of more importance in syphilis than in the other commoner infections. Its course is so protracted that it is the exception rather than the rule for its earlier, later, and terminal stages to be seen by the same observer; its manifestations are so varied that even a practitioner with the best opportunities cannot hope to see all its phases; and its consequences are so far-reaching that today, after centuries of study, its boundaries are still being extended. Even the specialist in the centres of population where the disease is most common is continually confronted with new problems, or new phases of old ones; and in general practice even the commoner phenomena of the disease are rarely encountered.

The treatment of syphilis, also, after many vicissitudes, has reached a stage in which there is practical unanimity as to the broad lines upon which it should be based. Not that one course is necessarily the best for all cases, and that it should never be varied; and still less that the future may not bring discoveries that may cause us to modify our plans. We shall undoubtedly at some time know more of the nature of the spirocheta and its products, as well as of the antibodies formed in the organism to

combat it; the newborn study of animal syphilis will doubtless teach us much; serum and vaccine therapy, still in their infancy, may revolutionize our methods; and nature may at any moment reveal to some one of its many earnest questioners means now undreamed of to combat this one of the greatest scourges of the human race. But at the point where we now stand it is safe to say that the main lines of treatment are standardized, and are generally accepted; and that the differences that exist between authorities are in matters of detail and individual choice, and that it is upon subjects of less than vital importance that the syphilographical world is still divided.

The following pages will be devoted to the consideration of the treatment of the general luetic infection both in its hereditary and its acquired form; the therapeutics of its various accidents, complications, and sequels; the consideration of the hygienic measures that play so great a part in the modern treatment of disease; and finally, to the discussion of the various means of personal and general prophylaxis that are of ever increasing importance and interest in this as in the other general infections. The recommendations given will epitomize the conclusions drawn from an experience of great extent with the disease both in public and in private practice. In many of the ambulant and hospital services with which I have been or am still connected the amount of material is so large, and the opportunities for investigation and experimentation are so extended, that most of the phenomena of the disease are observed in the course of time, and all new suggestions as to drugs, methods, etc., can be promptly tested. Especially is this the case in the New York City Hospital, whose syphilological service is by far the largest in this country, and where I have served for many years both as interne and as visiting physician. Due weight will be given to the conclusions of other observers, but the final test will necessarily be my own experience.

A satisfactory subdivision of so large a subject is necessarily difficult, and it is not possible to propose a strictly logical one based either on disease phenomena or on therapeutic measures. And since after all the chief object of classification is to enable the searcher to obtain information on any branch of the subject with ease, I have thought it better to arrange the entire subject under the headings under which the various measures are most likely to be sought; so that some will deal with general considerations, applicable not only to all stages of the disease, but even to non-infected individuals and the community at large, while others will be devoted to some special therapeutic measure of preëminent interest and importance.

THE HYGIENE OF THE SYPHILITIC.

As in all infections the course of the resultant disease depends necessarily upon three factors—the activity of the invading virus, the resistance of the receiving soil, and the efficacy of the instituted treatment. It is plain that the two latter may vary greatly, and I

am convinced that the same is the case with the first factor. For malignant cases of the disease occur from time to time under all sorts of conditions; cases in which the phenomena are violent almost to explosiveness; cases in which the nervous system is intensely involved, the early eruptions very abundant, suppurative and even ulcerative, and in which gummas and affections of the internal organs occur even before the chancre has entirely disappeared. It is true that in many instances these virulent outbreaks of the disease occur in debilitated or debauched individuals; but in others they appear in robust persons living under apparently proper hygienic conditions. Besides this the type of the disease acquired in certain parts of the world is distinctly severer than the one that we are accustomed to see here. This has been in my experience the case with infections acquired in China and the East, or gotten from individuals recently arrived from there. And since two individuals in apparently equally robust health acquiring the infection from two different sources may have symptoms on the one hand so slight that they are hardly noticeable, and on the other so severe as to threaten organ or life at the very outset of the disease, the conclusion is inevitable that differences in virulence exist in the virus. We may reasonably expect that study, cultivation, and propagation of the spirocheta may in the future afford evidence of this fact more satisfactory than that of clinical observation.

The receptivity of the soil in which the virus is implanted and the amount of resistance the tissue elements make to the inroads of the invading microörganism are indubitable elements in deciding the course of the disease; and to lessen the former and heighten the latter is the aim of treatment, second only in importance to direct action on the microbe itself. Here the hygiene of the syphilitic plays a most important part, and it will be convenient to discuss it under the following heads:

Physical Hygiene.—It is hardly necessary to emphasize the fact that all measures ordinarily recommended to improve the general condition are of special importance in the face of the systemic infection that we are considering. Regularity of life, abundance of sleep and rest, a nutritious and digestible diet, plenty of fresh air, bathing, moderate exercise, etc., must be insisted on; and all forms of dissipation, including such comparatively innocent ones as are ordinarily indulged in without danger, must be rigorously avoided. Daily cold spongings are admirably adapted to keep the skin in good condition and to improve its powers of resistance. Hydrotherapy and Turkish baths, sea-bathing when practicable, regulated gymnasium exercise when out-door exercise is not available, and other similar measures are to be prescribed for the patient. These things are of special importance for city people, who are very apt to lead a sedentary life, combined with excessive and over-rich eating.

Nervous Hygiene.—This is of exceptional importance in view of the fact that the nervous system is often markedly involved in the early onslaught of the disease as well as in its later stages. The persistent cephalalgia that is so noticeable in many cases is evidence of meningeal hyper-

emia at the very least; and the mental condition of many of these patients is often the cause of grave anxiety. They believe that they have contracted a shameful and incurable disease; and not a few of the mysterious suicides and so-called accidental deaths in the young are occasioned by this knowledge.

All causes of mental perturbation, anxiety, and worry must be avoided as much as possible; and where it can be done the patients, relatives, and friends should be enlisted to give their aid in these important particulars. Much will depend on the way in which the physician in charge handles the case, and on how much or how little he tells the patient as to his future prospects. No general rules can be laid down in this connection; each case must be judged and handled on its own merits. In some cases, as in that of a wife infected by her husband, where the latter appreciates the gravity of the infection and can take the precautions necessary for the protection of others, it may be proper and even necessary not to inform the patient at all of the nature of the infection and conduct the treatment under subterfuge. I have rarely consented to do so, however, believing the circumstances must be very exceptional that would justify the concealment from any individual of the existence of so serious an infection.

To the ordinary run of patients the fact of infection must be broken gradually and gently, for the shock of such an announcement is generally very great. Once apprised of it, I have found that the patients fall into one of two categories, very few of them, as is natural, being able to take a rational view of the misfortune that has befallen them. They either regard the thing lightly, ask only to be relieved of their immediate trouble, and are evidently destined to join the ranks of the imperfectly treated and contagion-spreading luetics; or they look upon the diagnosis as what is practically a death sentence, regarding themselves as doomed to all the horrors of a dreadful and incurable malady, and debarred for the future from all ordinary human intercourse. The former class, I think, is the harder to deal with. It is necessary, of course, to explain to them very fully the nature and course of their infection, and the dangers that confront them and their surroundings. In some cases, however, it is quite impossible to convince the optimistically careless that anything really serious is the matter. They take a little treatment and then disappear. To the latter class a wise reticence as to the possibilities of the case must be observed. It must not be forgotten that but a very small proportion of properly treated syphilitics suffer from the more serious accidents of the disease; that the prognosis as a whole is good, and that the chances are that the disease will run a mild and benign course. I do not hesitate to tell such patients that with proper care they will entirely recover, and that they will be able to marry and will have healthy children. For I believe very firmly that syphilis is a curable disease, and I know many cases formerly infected that have healthy wives and flourishing families. Accidents and bad cases may occur; a physician is not an insurance agent; a prognosis, of course, is merely an opinion as to the future course of the disease based on the teachings of experience; and

with sensible patients it is well to guard one's self a little. But in most instances it is a question of bridging over the immediate future and of sustaining them until the first shock effects have passed off. Later on, when they see how amenable to treatment the accidents that occur in nearly every case are, when they find how little their infection interferes with their ordinary avocations and habits of life, and when they find themselves for indefinite periods in normal physical health, they do not need our support. I do not hesitate to advocate painting a roseate view of the future to these cases; and even if we could know that for anyone the most undesirable sequels were in store, it would be our duty to emphasize the good prognostic possibilities only. As in the case of a patient with carcinoma of the stomach to whom a gastro-enterostomy has given relief, he should be told that he will entirely recover.

Sexual Hygiene.—This is a constantly appearing and difficult problem. Theoretically, and from the standpoint of the patient himself, it is readily answerable; moderate and occasional intercourse is the normal condition, at all events for the adult male. In concrete cases, however, the decision is not so easy. In married people, where the other partner has been already infected, rational intercourse is hygienic. Where one partner only has been infected the healthy person must not, of course, be exposed to the dangers of contagion. To unmarried persons the dangers of their contact must be explained. I am convinced that these dangers lie more in the buccal cavity than in the genital organs; a lesion of some kind being necessary for the exit of the virus from the infected body, and persons with lesions of the genitals do not usually have intercourse. The use of a condom diminishes the danger, and can be recommended. As a matter of fact, male adults who have been accustomed to have intercourse will not refrain from it when visible lesions have disappeared and bodily health regains its normal vigor. I make a general recommendation of abstinence, and order it whenever there are any active lesions anywhere; I explain the dangers to others, and the best means of avoiding them; and I do not attempt to enforce abstinence during the entire infective period, as I doubt its effect, hygienically, on the infected individual, and am convinced of its uselessness.

Hygiene of the Mouth.—The mouth is of special importance in syphilis for several reasons. It is very prone to be affected in the early stages of the disease, when the virus is most active; it is a source of contagion more subtle, and therefore often more dangerous, than the genitals themselves; and finally, it is apt to be injuriously affected by the very medication required for combating the infection. It is my invariable rule, therefore, to have the mouth attended to just as soon as a case comes under my care. The teeth should be put in good order at once; and I insist that the dentist be informed as to the patient's malady, so that he may protect both himself and others. This is not infrequently a matter of difficulty, the dental practitioner being a friend of the family, or the patient for some other reason being unwilling to reveal the nature of his malady to him. But I allow of no compromise in this matter; the patient can go to a strange dentist, if he desires, but he must be fully informed of the facts; or he

must take his chances with his teeth unattended to. The proper use of the toothbrush and of antiseptic mouth washes, etc., are required, and the excessive use of acid or irritant food, tobacco, etc., must be avoided. The regular employment of an antiseptic mouth wash is recommended. I usually prescribe the following:

R—Acidi carbolici	gtt. xxx
Spts. vini rect.	f℥ iv
Aq. destill.	f℥ iv—M.
Sig.—Mouth wash and gargle.	

The Intoxications: Alcohol and Tobacco.—These are the two commonest intoxications of our modern life; both exercise a most unfavorable influence, both local and general, on the course of syphilis, and the hygiene of the syphilitic demands their avoidance in part or wholly. Not only does the local irritant action of alcohol favor the development of mouth lesions in syphilitics; not only is there good reason to believe that acute intoxication plays a part, accidental or other, in favoring the implantation of the virus; but it is a well-recognized fact that chronic alcoholism is one of the most important factors in determining the gravity of an infection. It is in these cases that we see the malignant and precocious syphilides, the recurrent mucous patches, the irites, and the cerebrospinal lesions. Alcoholics, with their damaged organs and generally depressed vital functions, are naturally the worst possible cases for an infection of this kind; and an absolute avoidance of wines, beers, and liquors of all kinds should be made an absolute rule.

The evils from tobacco are almost as evident. Smoking and, still more, chewing powerfully predispose the patient to the appearance of mucous patches of the palate, lips, gums, and tongue, and keep them up indefinitely as sources of trouble and contagion. In the later stages of the disease the most obstinate forms of superficial and deep glossitis of syphilitic origin are so distinctly due in part to tobacco that medication is entirely unavailing so long as smoking is kept up; and in the latest stages it occasions a particularly obstinate gummatous glossitis which Fournier has called "glossite syphilonicotique." Finally, it is reasonably sure that those obstinate and distressing cases of leukoplakia that eventuate in cancer are in most cases due to the combined noxæ of syphilis and tobacco. Of the bad effect of tobacco in excess on the gastric organs and the nervous system I need not speak. Enough has been said to impress upon the practitioner the importance of cutting off tobacco entirely as a measure of syphilitic hygiene, or, at all events, of very greatly limiting its use.

Other Local or General Maladies.—It is readily conceivable that other diseases may aggravate a syphilitic infection or determine the localization of special accidents. The treatment and cure of these affections, therefore, form a part of the hygiene of the disease. Tuberculosis, anemia, paludism, etc., demand appropriate treatment; as also do all local affections. It is outside our province to do more than allude to these here. In spite of the ideas prevalent in some quarters, it may be laid down as a rule that any affection, local or general, can only have an

unfavorable effect on the course of a luetic infection; and that it is an essential part of the hygiene of the syphilitic to cure it as soon as possible, or, at all events, to keep it under control by appropriate treatment.

THE PROPHYLAXIS OF SYPHILIS.

This branch of our subject includes the various measures to be recommended for personal avoidance and social limitation of the contagion both in general and under such special circumstances as marriage, pregnancy, etc., and it may profitably be preceded by a brief consideration of important factors in the prevention of the disease.

Predisposing Factors.—Prostitutes, of course, practically never escape the infection; and certain professions and trades, physicians, midwives, laundresses, glassblowers, etc., are especially exposed to it. Uncleanliness, especially after intercourse, is naturally a factor of importance; and so also, we have every reason to believe, are bad hygienic conditions, depressed vitality from any cause, and other diseases. Intemperance at the time of infection is undoubtedly a predisposing factor, though possibly more on account of its influence in causing prolonged, careless, or excessive intercourse than from any direct predisposing effect. My experience is decisive on this point: most infections are gotten while under the influence of liquor.

Contagiousness of the Various Lesions.—A knowledge of the facts under this heading is of the very greatest importance, since there is much misconception in regard to it, especially among the laity. In a general way it may be said that lesions must be moist or eroded, or covered with a delicate and easily ruptured covering, as on the mucosæ, before the virus can reach a new subject. This holds good of the chancre and all the lesions of the earlier, so-called secondary eruptions. Even insignificant lesions, possibly not syphilitic in their origin at all, may contain the virus in the earlier stages of the disease, provided they are moist. The blood of secondary syphilitics may be contagious, as has been proved by direct inoculation on man and monkeys. That the semen contains the virus is shown by the occurrence of paternal heredosyphilis, and has been demonstrated experimentally. And while the milk, the saliva, the nasal and bronchial mucus, and other natural excretions do not necessarily contain the infective organism, they come in contact with surfaces so prone to be infected and to show moist lesions that they are undoubtedly an occasional source of contagion.

The occasional contagiousness of tertiary lesions, long denied, can no longer be doubted; it has been proved experimentally by animal inoculations made by Finger and Landsteiner, Neisser and others. The virus is, however, greatly attenuated, and infections from these late lesions must be very rare.

The lesions of heredosyphilis, of course, are contagious in the same manner as those of the acquired form of the disease.

Modes of Contagion.—It seems questionable today whether a solution of continuity is absolutely necessary for the implantation of the virus.

Neisser has had infection occur through an apparently unbroken skin. In most cases the virus is transmitted directly, and during sexual intercourse; but this is only because it is during coition especially that infected and healthy individuals come into prolonged and intimate bodily contact. I have long noted, however, the large proportion of cases, both public and private, in which the infection is extragenital and probably unconnected with intercourse. Further consideration of this subject is not proper here; it will suffice to call attention to the fact that in a considerable proportion of cases, at least, toilet or table articles, tooth-brushes, glasses, sponges, forks are the mediate carriers of the virus; as also are pipes, penholders, surgical or dental instruments, etc.

Personal Prophylaxis.—Undoubtedly many cases of infection are avoided by this means, for if every prostitute with infective lesions communicated the disease it would be much more prevalent than it is. Accident undoubtedly plays a part, but cleanliness and antiseptic washings deserve much credit. The free use of soap and water after a suspicious intercourse, the employment of carbolic or lysol or sublimate solutions, and the prompt destruction with the thermocautery or actual cautery, or with nitric acid in preference to nitrate of silver, of any lesions or solutions of continuity observed after coitus, will prevent many infections. Ablation or destruction of the chancre deserves consideration as a prophylactic measure, and will be spoken of later under the more immediate therapeutics.

Quite recently Metchnikoff and Roux have advocated a prophylactic measure that is readily employed, and is harmless. A 33 or 50 per cent. calomel ointment, or the strong mercurial salve, is to be thoroughly inuncted into any infected or suspected region; the operation should take ten or fifteen minutes. Neisser holds that a 2 to 3 per 1000 sublimate solution is still more efficacious. Experiments on animals, and in one case in the human being, gave the first-mentioned investigators good results; but they have not been confirmed by Gaucher among others. It is not possible as yet to give a definite judgment as to the value of this prophylactic measure, and from the nature of things it will be very difficult to do so. Escape from disease after an infected intercourse will mean little; most cases do escape, anyway. But the measure is so simple and so harmless that I have no hesitation in recommending it when I am asked to advise as to prophylaxis. When there is a lesion after intercourse I first use the galvanocautery thoroughly, and then dress with the calomel ointment. In view of the proved inhibitive effect of mercury on spirocheta growth the local application of the drug to a place where infection may have occurred can only do good.

Some authorities lay stress on the inculcation of precepts of morality as a measure of personal prophylaxis. I agree with all that they say; their efforts are commendable; but they seem to me to be a little besides the physician's office, and, above all, they are useless. In our large cities, at all events, the young male adult is continent only in very exceptional cases. And after marriage, I am sorry to say, the same holds true to a very large extent. It is well known to those who come in contact with

them that the mass of the prostitutes in the great cities are supported by married men. Continnence, of course, is an absolute safeguard from genital infection; but not even the fear of infection, great as it is, can cope with the stimulus of the sexual impulse. It is legitimate, under these circumstances, to advise the use of the condom as a prophylactic measure; though I find but very few individuals who are willing to employ it.

Social Prophylaxis.—This is a large and vexed question, on which many volumes have been written and for which national societies have been formed. I shall touch only on the main points.

The relations of a wet-nurse and an infant confided to her care are such as to impose the very gravest responsibilities on the practitioner who selects the former; and that toward both parties concerned. Only a thorough examination of the woman as to scars in the vagina, mouth, etc., glands, and into her history as to previous illnesses, abortions, etc., together with a Wassermann blood test, can give us any certainty that she has not had an infection that may permanently injure the infant. Conversely, of course, a syphilitic child must under no circumstances be nursed by a healthy woman; the mother or the bottle only are admissible. Many heredosyphilitic children show no evidences of the disease until some months after birth; and it is usually only the family physician who has confined the mother, and who probably knows both parents, who can satisfactorily pass judgment.

As regards the trades in which the chances of infection are great, as among the glassblowers, the precautions to be taken are such as would necessarily suggest themselves. Among physicians, dentists, nurses, and hospital attendants infections are unfortunately not uncommon. Careful antiseptic washing after handling contagious cases, the use of rubber finger cots or rubber gloves when doing so, and especially when making rectal or vaginal examinations, doing prostatic massage, etc., are necessary. Personally, I never make a digital examination of any cavity or secreting lesion without this latter precaution. Any accidental lesion of the hands acquired during an operation, or any exposure of a fissure or a hangnail to contagion calls for a thorough cauterization. I prefer either nitric acid applied by means of a pointed glass rod or the galvanocaustic point. I do not consider it safe to rely on the tincture of iodine, as Nicolas recommends. The cauterized part should then be covered with a wet bichloride or dry antiseptic dressing.

Vaccinal syphilis is mainly of historical interest to us today, since arm-to-arm inoculation is no longer practised. Occasional accidental inoculations do, however, still occur from carelessness in the sterilization of the instruments employed. It cannot occur, of course, where modern methods of vaccination are used, and a new needle is taken for each inoculation. Where the same instrument is used for successive vaccinations careful sterilization by flame or boiling will obviate all possibility of such an unfortunate occurrence.

The protection of the family and surroundings of an infected person presents problems that vary greatly in difficulty, and which must be met with in accordance with the circumstances of each case. One point

I insist upon always, and that is that some one of authority in the patient's surroundings, a parent if he lives at home, the wife or husband, or some responsible adult, be informed of the patient's condition and of the dangers to those about him. The precautions that must be taken, especially during the earlier and more dangerous stages of the disease, are so manifold and complicated that they will never be effectively carried out unless those in authority in the household are made aware of their necessity. The natural desire for secrecy regarding the infection often places difficulties in the way; but it is self-evident that the attendant, so far as his influence and authority goes, has no right to permit any course that will increase the danger, great enough already, to the family and surroundings of an infected person. The ultimate decision must, of course, rest with the patient himself; but I have found very few persons who did not accept the proper view of the matter when it was placed before them.

The precautions themselves are self-evident. If the patient can leave his family for a time, and live in a hotel or in lodgings where his precautionary measures will not be watched, it is desirable for him to do so. If he must remain at home, a separate sleeping apartment, individual and marked toilet and table utensils should be employed. All his linen should be boiled before being washed, more especially his handkerchiefs, towels, and table napkins. Metallic articles and crockery, knives, forks, spoons, glasses, cups, etc., should be subjected to the action of boiling water, sterilized in a lysol or other antiseptic solution, etc., before being washed. The exact amount and nature of the precautions to be used will vary, of course, with the circumstances and the case. If the patient is under close and continued medical observation the segregation may be less rigorous during periods when there are no active or secreting lesions. There is hardly any danger from dry lesions on the surface of the body, or from the natural secretions, as those of the mouth, when that cavity is in good condition. But secreting lesions may appear at any time, and constant surveillance is the price of safety. It goes without saying that during the entire active period of the infection, covering at least the first eighteen months, intercourse, kissing, etc., with uninfected persons must be rigorously avoided.

Public Prophylaxis.—I do not propose to more than touch upon this vexed question, giving the conclusions that I have reached. Prostitution is, of course, a great and perhaps the greatest source of syphilis; but it is by no means the only one, a large, though unascertainable proportion of the cases being from non-prostitutes or extragenitally. I find from my office records that fully one-third of all my private cases come under this class, being either non-sexual and extragenital in origin, or occurring in the marital relation, or gotten through sexual relations with women who were not prostitutes. The reasons for this are evident. Public women are of necessity scrupulously clean, and that of itself greatly diminishes the danger of infection. Intercourse is not likely to be permitted while vaginal lesions are present, since they are well aware of its danger. Practically all of them contract syphilis by the time they

have been "on the town" four years, as the investigations of the public women at Magdeburg show. But the actively infective period does not last very long, and vaginal and mouth lesions are rare on account of the hygienic care taken of these cavities. As a matter of fact, an assistant of mine, who has had opportunities of examining large numbers of prostitutes, has commented to me on the extreme rarity of syphilitic lesions of any kind among them, and the great care that was exercised by such as were infected. And, on the other hand, the non-public woman is not only less cleanly, but she is necessarily more ignorant of the danger or more careless if she knows it. A large proportion of genital chancres are gotten from women who cannot be classed as prostitutes and who are necessarily beyond the scope of all preventive measures.

These facts explain the practical failure of preventive treatment as applied to public women in many of the countries of Continental Europe. Registration of public women, detention and hospital treatment of cases among them, and all the various forms and degrees of regulation have now been tried for many years without any definite results. It does not seem that syphilis has decreased in any noticeable degree. It does not seem to be more rampant in England and America, where nothing of the kind has been done, than in France and Germany, where these measures have long been in use. Besides this, they involve a degree of police interference with personal liberty that is repugnant to us. I would not be understood by this as saying that compulsory notification of cases of syphilis and registration and detention, while under treatment, of prostitutes are not measures that may be of some use, and to which we may resort in the future; but they have obvious disadvantages, and the results where they have been enforced have not been sufficiently good, in my opinion, to counterbalance them.

The education of the public, and especially of the young, in the dangers of the disease and the means of avoiding them is a prophylactic measure that has its disadvantages, but that in general is to be commended and helped. The efforts made in that direction deserve sympathy and support.

Syphilis and Marriage.—This is a question that arises with great frequency, and one on which, from the standpoint of the prophylactic treatment, our ideas should be clear and definite. Experience has led me to formulate the following rules:

(a) Three years under proper treatment, followed by one year without treatment and without symptoms, is the minimum time after which an infected patient has my permission to marry.

(b) Cases showing symptoms after that period do not get permission to marry even when the lesions are apparently innocuous. They require treatment.

(c) Cases acquiring syphilis after marriage are subject to the same rules as regards intercourse as are those desiring to marry. Marital abstinence for the full period is required to avoid maternal infection and conceptional syphilis.

(d) Precautionary measures, such as the use of condoms, avoidance of kissing, etc., are to be advised in the later periods if abstinence cannot be enforced.

(e) Every syphilitic, no matter how old his infection, should have a course of treatment before contracting marriage.

(f) The Wassermann blood test, repeatedly made by a competent observer, gives us an index that at this writing seems reliable as to the patient's condition. Four to six tests, made at intervals of a few weeks, and uniformly negative, would demonstrate the absence of danger.

These are the rules that I invariably lay down, though they have by no means been uniformly observed. Sometimes they cannot be enforced; but so far as possible they must be insisted on, and the responsibility for breaking them be placed on the patient. Under those circumstances the latter should be under constant and careful observation and treatment, special attention being paid to the mouth and throat; and full information should be given as to measures to be taken to avoid accidental infection of the partner. I have had patients commit the crime of marriage while in the earlier stages of the infection, and have succeeded, with care and attention, in preventing transference of the disease.

The Prophylaxis of Heredosyphilis.—The man affected with syphilis should not procreate until five years after the contraction of the disease, and after an effective treatment for a sufficiently long time. In any case, and more especially if the original treatment has been insufficient, it will be advantageous to administer a short antisypilitic course before procreation. In cases of severe or relapsing lues procreation should be avoided as long as possible. Nevertheless, instances are on record in which apparently healthy children have been born to a father who was in the first year post infectum, but under constant and careful treatment; though whether such children have remained healthy, or have shown later symptoms of the disease, has not been ascertained.

With the female syphilitic we must be even more careful, for the possibility of hereditary transmission lasts much longer with her than with the father. Pregnancy should be postponed as long as possible, and when it occurs a vigorous course of treatment should always be instituted, and kept up, if possible, up to the time of labor and beyond it. In many cases where either the father or the mother or both have been infected it is necessary to keep the woman in ignorance of the fact; in which case it is well to inform the physician in charge of the accouchement of the facts and necessities of the case, so that the mercurial treatment can be administered under the guise of a tonic or other needed medication.

Chancre Excision.—From a common-sense point of view this procedure would seem desirable, more especially when the initial lesion is located on the general integument, on the prepuce, or in any other situation where it could be readily removed. There must certainly be a time, no matter how short, when the virus is localized at the point of infection; and it would seem rational to attempt to prevent its spread by a radical removal of the infective focus. And even if this attempt were not successful, the removal of such an area would be justifiable on general surgical

principles, provided that the operation could be carried out without too much trouble or mutilation.

The therapeutic results from this measure as practised by the investigators of earlier date were unsatisfactory; induration developed in the resultant scar, and general infection was not avoided. Authorities like Kaposi, Fournier, Mauriac, and Taylor have pronounced themselves as flatly opposed to it as a therapeutic measure, claiming that no matter how early it was done it had no appreciable influence on the course of the disease, and merely subjected the patient to the discomfort of a useless operation.

It must be noted, however, that these opinions have been based in trials made in times when our methods of chancre diagnosis were much less refined than they are at present, and that many of the records are invalidated by the facts that the operation was done too late or the patient could not be followed up sufficiently long to permit of judgment as to the general course of the disease. Complete abortion of the infection was the end aimed at; and when this was not attained, an absolute failure was noted. There are no records of these earlier authorities that I know of as regards any possible influence of the operation on the subsequent course of the disease; and in the nature of things these could only be gotten by the analysis of a large number of cases in which it was done, and the comparison with other cases similarly circumstanced without it. No one can tell at the beginning whether a given case will be severe or mild. In the absence of knowledge of the spirocheta the diagnosis of a lesion as a chancre could not be made with certainty until at least the earliest secondary sign, the specific local adenopathy, appeared; and then it was too late, for the virus had by that time certainly spread beyond the local original focus.

During the last few years, however, conditions have changed. The microscopic diagnosis of the spirocheta can be made in a few minutes and from the most insignificant beginning lesion. In skilled hands it gives the requisite datum to decide on the nature of a suspected lesion; there is no need of waiting until confirmatory secondary symptoms due to extension of the virus substantiate it. Hence the chancre can be diagnosticated practically at once, and the just criticism of the older recorded successes, that the excised lesion not followed by a general infection was probably not a chancre at all, falls away. The results also have undergone a change. Thus, Neisser has had experimental inoculations carefully made on apes, and followed by excision, with complete success in aborting the disease. Neumann, Matzenauer and others have absolutely aborted the disease in several cases in the human subject, and in every instance have recorded a notable diminution in the intensity of the infection. The statistics of the more recent excisions collected by Sibut show 5 per cent. of complete successes and 16.5 per cent. of attenuations of the following syphilis. Nicolas in his most recent work, published in 1909, advocates the measure warmly, considering it as at least experimentally justified.

I myself have practised it in a number of cases, only a few of which,

however, were private ones which I was able to follow up. Of these half-dozen cases, five were failures as regards the abortion of the disease; nor am I able to say that the procedure had any notable effect on the subsequent course of the malady. In one, however, there was complete success, and under circumstances that were such that there could be no doubt of the nature of the lesion and the success of the abortive treatment. The patient had had his chancre one week, local adenopathy had hardly begun, and the location of the lesion on the loose remains of his circumcised prepuce was such that ablation without deformity was easy. It was done under cocaine, the ablation being wide of the indurated area; the wound healed per primam, and did not subsequently indurate. The patient was under close observation for over eleven months, and was seen a number of times after that; there were never any evidences of systemic infection. This was ten years ago, and long before the discovery of the specific microörganism; but the ablated specimen, which was clinically a typically indurated chancre, has served since then as a source of typical sections of hard chancre in my laboratory. There can be no doubt at all as to its nature.

Excision of the chancre, therefore, is a therapeutic measure, to be considered when the conditions for the operation are favorable. When it is situated on the glans I consider it inadvisable, on account of the difficulty of securing union, the possibility of hemorrhage, and the necessary subsequent mutilation. But on the prepuce or sheath of the penis, or in extragenital locations, it can be done. Not only is a large infective focus radically removed, but the effect on the patient's morale by the substitution of a clean wound for the lesion is an excellent one.

The operation itself is usually readily accomplished. When the lesion is seated on the prepuce, circumcision is usually advisable, special care being taken to avoid infecting the incision from the lesion. I prefer the use of the clamp, since by its means the chancre can be isolated from the rest of the tissues and the cut surfaces kept sterile. Where the tissues are abundant it is well to clamp off the lesion itself with a smaller curved forceps; apply the circumcision clamp behind it and cut between. Where complete circumcision is not desirable or possible the chancre itself can be clamped and ablated with the curved scissors. Cleansing and suturing should be carefully done, and an ordinary wet bichloride or dry antiseptic dressing applied. Local eucaïne or cocaine anesthesia only is required.

THE WASSERMANN SERUM TEST AS A GUIDE TO TREATMENT.

General considerations as to the new reaction and the details of its methods are not in place under this therapeutic heading; we are here concerned with it only in so far as it can be used as an indication for treatment. It is a little hazardous at this writing to be dogmatic concerning the serum test; nevertheless, the general trend of observation is decidedly in the direction of proving its reliability. Hundreds of

thousands of observations in all parts of the world are responsible for the gradually increasing confidence with which it is regarded by syphilographers.

The exact limits of reliability of the test, however, are not yet fixed, and fortunately this is not of importance in our present consideration. One necessary condition, of course, is that the test be made by an expert; only one who is thoroughly conversant with the technique and who has the resources of a properly equipped laboratory at his command can get results to be relied upon. Given that condition, I regard the test as reliable, though no more so than any other single symptom of the disease. A positive serum test, especially if gotten more than once, is as reliable an evidence of the presence of syphilis as a symptom gotten in other ways.

I rely, therefore, on the presence of the serum test in all cases in which the other evidences are not conclusive. Its positive presence shows that more treatment is required just as much as an evident lesion of the skin or an internal organ. It is useful as an index to treatment in all cases of doubt. If the symptoms, early or late, are indeterminate; if it is a question whether treatment has been sufficient; if the question arises as to the propriety of antiluetic treatment in any obscure affection; if a decision as to marriage and the prospects of transmission of the disease arises, in all such cases the serum test is a valuable guide. More than that, it can be employed, if desired, to regulate the amount and time of treatment.

It is unfortunate that up to the present time the test is complicated and expensive, and therefore cannot be used as freely as might be wished. I have no doubt, however, that the efforts of Noguchi and others to simplify it will eventually be crowned with success, and that the serum test will take its place with the microbiological one as a readily employable indication in the therapeutics of the disease.

SPECIFIC MEDICATION.

The experience of generations has shown that the one reliable drug for the cure of the luetic disease is mercury, and that in all its stages, from the primary lesion to the latest tertiary effect. Iodine, usually mentioned at the same time, is important and has its uses; but its employment is entirely subsidiary to that of the former drug. Abundant experimentation with all kinds of other medication has not yet succeeded in displacing it. Of the many substitutes from the mineral and vegetable world that have been proposed, some, like the salts of the precious metals and vegetable extracts, have sunk into disuse after varying periods of popularity; others, like the newer organic arsenic preparations, are at the present time the subjects of experimentation and investigation. Brief mention only will be made of the former class; the latter will receive such consideration as the data now obtainable will allow; but the main subjects of the following pages will be the recognized and

approved and efficient drugs employed in the treatment of the disease, their indications and contraindications, and the various modes of their employment.

Mercury.—Since it was first tried in the sixteenth century for the disease, and in spite of improper employment and abuse that led to violent reactions of opinion against its administration, mercury has maintained and still holds its place as the one drug to be relied upon to combat the microörganic cause of the luetic disease. Administered in enormous doses in the early days, it undoubtedly in many cases caused serious trouble, and the reaction against it went so far that even the effects of the disease were attributed to the use of the remedy. Popular opinion, as usual, reflects the medical ideas of a generation or two ago, and an appreciation of and dread of the evil effects of the mercurial medication is still present in the minds of many of our patients.

The Action of Mercury in Syphilis.—Though we are as yet unable to explain its precise nature, there can be no doubt at all that mercury has a direct action inimical to the development of the spirocheta. Not only does it prevent its growth in places where it has been implanted, and thus give the natural reparative powers of the tissues a chance to manifest themselves, but its presence in the fluids and tissues of the body prevents new implantations and subsequent growth occurring. Its preventive action is shown by numerous well-known facts. Its administration postpones and may even prevent the appearance of the ordinary secondary symptoms, and tertiary phenomena of all kinds are very much rarer than usual in cases that have received thorough and efficient mercurial treatment. That this is true of heredosyphilis also is proved by common observation; Turmann's celebrated case is a good example of it. An untreated syphilitic woman had successively seven syphilitic infants that died of the disease. Treated during her eighth and ninth pregnancies she had two healthy children that survived. In her tenth pregnancy, untreated, she had a heredosyphilitic child that died in a few months. Finally, in her eleventh pregnancy she was treated again and had a healthy living child. Such instances are among the reasons why I advocate a continuous, or rather a chronic, intermittent treatment, and not the purely symptomatic courses that are advised by some Continental authorities. This subject will be reverted to when discussing the courses and duration of the mercurial medications.

Levy-Bing has shown that mercury acts as a distinct parasiticide to the spirocheta, and it is a matter of common experience that the organism is much harder to find or impossible to demonstrate in an initial lesion or an active secondary focus that has been subjected to local mercurial treatment. It is, of course, possible, though it has not as yet been demonstrated, that the drug has some action on the tissues inimical to parasitic life in addition to its direct action on the microörganism. Naturally, of course, mercury interferes with the serum reaction, so that in cases under treatment it may be indeterminate or negative.

Absorption of Mercury by the Organism.—This has been the subject of much painstaking investigation and protracted discussion, without,

however, any absolute certainty being reached. Introduced into the organism in different ways, and in all manner of chemical combinations, its action is in general the same. It was long believed, following the experiments of Mialhe and Blomberg, that the metal was absorbed as a peptonate or albuminate; but it has been found impossible to demonstrate any such combination in the blood. But whatever the chemical transformations that the drug administered undergoes, and these are doubtless extremely complex, all the most recent investigators agree that the end result is the formation of metallic mercury in infinitely finely subdivided form (Emery and Chatin, Nicolas, etc.). In this form it penetrates the capillaries and reaches the general circulation. Free mercury is the ultimate end of the transformations. Hence is explained the fact that equal amounts of different mercurial preparations differ in therapeutic effect, not only in accordance with the amount of metallic mercury that they contain, but also in accordance with the ease with which the combinations are dissociated and the metallic mercury is released.

Elimination of Mercury by the Organism.—All the emunctories take part in this, but first and chiefly the kidneys. It is found later in the urine, feces, saliva, milk, sweat, and bile; and it has even been demonstrated in the tears and in the pus from an abscess. Renal irritation is of not infrequent occurrence during a mercurial course, as shown by the presence of albumin and some hyaline casts. It is always advisable, therefore, to control the medication by frequent urinary analyses.

The rapidity of elimination, the time when it begins, and the period for which it persists after medication is stopped depend on the preparation employed, the mode of administration, dosage, etc. Thus after injections of the biniodide it can be proved in the urine in an hour (Nicolas and L'Heureux), after inunctions in three to twelve hours, and after ingestion in three to twenty-four hours. Elimination attains its maximum in a short time, and remains at that height; and administration in excess of that amount means accumulation in the organism, and possibly an explosive outburst of poisoning. Unfortunately, we do not have at our disposal any ready method of determining the amount of mercury eliminated in the urine. The simplest, that of Merget, is too complicated and requires too much chemical knowledge for use in practice. I rely on the therapeutic effect and the state of the kidneys to determine the dosage. In a new case, however, that has not had mercury before, I am careful to begin with a small dose and watch the urine closely.

Mercurial Accidents: Hydrargyria.—Mercury is a poison, indubitably; and damage and even death can occur from its exhibition. Individuals of ordinary susceptibility may suffer from its use, and when idiosyncrasy to its action exists even small amounts may be harmful. The same holds true of every powerful therapeutic agent; and certainly, in the case of this drug, its beneficial action is so general and so marked as to render its drawbacks of very minor importance.

The skin in a few cases is extremely susceptible to the drug when applied externally. I have myself met with one case in which the smallest amount of the drug, applied externally or ingested or injected, caused a

scarlatiniform and polymorphous erythema of such intensity as to absolutely prevent the employment of the remedy. Purpura occurs, and erythema multiforme; and on the hairy parts a suppurative folliculitis is not uncommon from its external application. In general it may be said that while a good many skins are susceptible to mercury externally used, but very few indeed show dermal reactions in consequence of its internal administration.

The Mouth: Mercurial Stomatitis and Salivation.—This is the commonest undesirable effect of the mercurial medication, and while it may occur with any preparation and any form of administration, it is very much more frequent in some than in others. It cannot always be avoided, and in obstinate and serious infections its presence in moderate degree, while undesirable, is no indication for a stoppage of treatment. Infusions are most prone to occasion it, possibly on account of the fact that most of the mercury reaches the organism through the mouth, as will be seen later. The soluble salts show it oftener than the insoluble when injections are employed, and it is a not uncommon occurrence under oral medication. The condition of the patient's mouth and teeth has much to do with its occurrence; hence the invariable rule to have the cavity put in as good condition as possible at the beginning of the treatment, and to pay special attention to its care during its course. In the worst cases, gangrene and sepsis supervene; and I have several times had patients admitted to my service at the City Hospital in lamentable condition from this cause; two cases at least have died of sepsis.

The Gastro-intestinal Tract: Gastritis, Enteritis, etc.—These affections are rare when mercury is administered by other ways than the mouth, and it is especially the bichloride and biniodide salts that occasion them. It is usually necessary to suspend the administration of the drug for a time, and when it is resumed it should be under another form of administration.

The Liver.—Simple icterus is of not infrequent occurrence during the early stages of syphilis, but it is probable that both this and the grave form are due to a syphilitic hepatitis rather than to the action of the mercury. Such is the opinion of Emery and Chatin, perhaps the latest investigators of the subject.

The Kidneys.—Attention has already been called to the importance of these organs in the elimination of mercury from the system, and the question of the administration of the drug in the presence of defects in the eliminative powers of these organs. Mercury itself is a renal irritant, and its administration to a patient with organs already damaged may well put a burden on them under which they will break down. An attempt must be made, if possible, to treat the renal condition, and especially to decide if the kidney symptoms are organic and permanent, or temporary and evanescent. If the albuminuria is abundant and persistent, if it has followed an infection, or a fever, or rheumatism, or if it is associated with the cardiac, vascular, and other symptoms attendant on chronic renal disease, mercury must be administered with extreme caution. It is a question in my mind whether such a patient does not

stand a better chance without the drug. Of course, the great majority of infections occur in early life, when the kidneys are usually healthy.

The Nervous System.—Neuralgia, polyneuritis, tremors, convulsive attacks, paralyses, and various forms of psychic change have been attributed to mercury, and in rare instances undoubtedly with justice. Yet, with the exception of the last, in most cases the syphilis itself, and not the drug given to cure, is to be accused. Mercury in some few instances exercises a peculiarly depressing effect upon the patient's mind, and in such cases it may be necessary to stop the administration of the drug and resort for a time at least to the various medicinal, tonic, and physical agents usually employed for neurasthenic conditions.

General Nutrition.—In the vast majority of cases the patient's general condition is steadily and markedly improved by mercury, and this is true not only of those whose symptoms are mild and who receive moderate amounts of the drug, but also of those suffering from malignant forms of syphilis, and where the dosage has to be heroic. It is in these latter cases, as a rule, that the improvement is most striking; *pari passu* with the improvement and disappearance of the lesions the appetite increases, the patient takes on flesh, sleep becomes better, and the entire physical and mental condition improves. The exceptions to this are happily rare; in most cases the syphilitic thrives on mercury, which is a true tonic to him. In the exceptional cases in which mercury apparently has a bad effect on the general condition, and in which cachexia supervenes, there are either kidney or other internal defects that interfere with mercurial elimination, or the condition is due to the syphilis itself.

Mercurial Preparations and their Administration.—In this section I shall devote but small space to preparations and methods that are presumably well known, reserving my attention to some less popular ones which the experience of many years has shown me to be the best.

Administration by Ingestion.—Administration by the mouth is the oldest and still the most generally employed method of mercurial administration. It is the simplest and most cleanly, but it has disadvantages and drawbacks so marked that it has long been largely abandoned by syphilologists. It is slow, so that it cannot be advantageously used in urgent cases; and under certain circumstances it is ineffective as compared with other methods. It is uncertain, inasmuch as we have no means of telling how much of the drug has been absorbed, and how much of it has passed through the intestinal tract unused. It necessarily puts the stress of absorption of an irritant and poisonous medicament on the intestinal canal; dyspepsia, gastralgia, enteralgia, and diarrhea from its employment are frequent; and it cannot be used to advantage in patients with enfeebled or deranged digestion. Salivation is of frequent occurrence. The necessity of the patient taking medicine several times a day for long periods lays him open to detection; and syphilis is pre-eminently a disease whose presence it is desirable to conceal from those who have no business to know of its existence. This same last consideration renders the method very irksome to the busy man, who is extremely apt to neglect or forget his medication during the long periods when there

are no signs of active disease. An important disadvantage also is the fact that it practically puts the treatment in the hands of the patient; he takes his medication when and how he considers proper, and the attendant loses that exact control over the treatment that can only be gotten by seeing the patient frequently and regulating the medication that he undergoes. I employ the ingestion method only as a subsidiary one in the exceptional cases in which it is not feasible to use that of election.

Many forms of mercury are used for oral administration. I shall mention only those most commonly employed. The *protoiodide* in $\frac{1}{6}$ to $\frac{1}{2}$ grain doses is probably the favorite. It contains over 61 per cent. of mercury; it is very liable, however, to cause intestinal irritation, especially the American preparation in tablet form. A formula for the protoiodide, guarded to obviate intestinal irritation, is the following:

R—Hydrarg. protoiodidi gr. x
 Pulv. opii gr. x
 Excipientis q. s. ut ft. pil. no. 1.

I much prefer the French pills of Garnier and L'Amoureux, $\frac{1}{6}$ grain each, which are readily obtainable here. The *biniodide* and *bichloride* are intensely irritant, and very prone to cause salivation. I use them only when circumstances do not permit injections. A good general formula is as follows:

R—Hydrarg. biniodidi vel chloridi corros. gr. j to iv
 Syr. aurant. cort. ʒss
 Aquæ ad ʒiv—M.
 Sig.—One teaspoonful, three times a day, after eating, in plenty of water.

The *tannate of mercury* in $\frac{1}{2}$ to 1 grain doses is a mild preparation that is useful especially for administration to children, since it is practically tasteless, and can be given in the food, or as a powder, with sugar of milk, or as a capsule or tablet. *Hydrargyrum cum creta* may be employed in 1 to 3 grain doses under similar circumstances.

Administration per Rectum.—This method of introducing mercury into the system has been advocated especially by Audry in the form of small rectal injections or suppositories, more especially in cases of gastric intolerance to the drug. All the stronger salts were naturally found very irritant; and the only one that I can recommend is that of 40 per cent. gray oil (metallic mercury and oil well rubbed up) in suppository form. From $\frac{1}{10}$ to 1 per cent. of the drug per suppository has been useful in occasional cases where rectal or anal lesions were present, thus combining local with the general treatment. Absorption of the drug is fairly good; but the method is open to all the objections of the ingestion method, and is infinitely less cleanly and more troublesome.

Administration by the Skin.—This method includes mercurial inunctions as well as various subsidiary modes of introducing the drug through the skin. It is that of election by some authorities, and is generally employed on the Continent of Europe; it therefore merits consideration. It has never obtained any vogue here, for obvious reasons. Most of the

objections to the buccal method of administration apply to it, and it has some serious practical ones of its own in addition. The dosage is entirely uncertain; we can have no knowledge at all as to how much of the inuncted metal is absorbed by the skin or inhaled in vapor form by the lungs. As a matter of fact, recent investigations tend to show that the method is in part, at least, one of administration by inhalation. Inunctions made under circumstances precluding inhalation, as on the skin of a limb thrust through a partition into another room, have been found of little therapeutic use. Under ordinary circumstances they are done in a closed, warm room, often at night, with artificial light and heat, and it is then that they are most effective.

But the main objections to this form of administration, whose effectiveness cannot be denied, are the time that it consumes, its dirtiness, and the fact that of all the methods of administration that can be employed it is the one that can be perhaps least readily concealable. No other method makes so great a claim on the sufferer's patience and time; no other is so repugnant to cleanly persons; and no other can be less readily carried out in secrecy. Small wonder, therefore, that it is practically little used by American physicians. I have employed it only in Europeans who demanded it, or when acting in conjunction with European physicians who were prejudiced in its favor, or finally in an occasional case where injections or buccal medication could not be used.

The best preparation to employ is the so-called *Neapolitan ointment*, composed of metallic mercury and benzoinated lard in equal parts. One dram is the average beginning dose for male adults, to be increased to 2 or 3 drams, as occasion requires. Children and women, of course, take less. The inner surface of the thighs, the flanks, and the arms are the locations to be employed; they are used in succession, so that with one inunction daily it is a week before the same skin surface is inuncted again, for more or less dermal irritation is frequent, and a folliculitis is apt to occur if the hairy parts are subjected to the mercurial influence. Very hirsute individuals, in fact, cannot stand the method at all. The best time to practise it is at night, in a warm room, and before going to bed. The operation takes ten to fifteen minutes. It should be done firmly, but gently, and until most or all of the ointment has disappeared. If the inunctions are made by other than the patient himself the operator's hand should be protected by a leather or rubber glove. The residual ointment is left upon the skin; and since the linen would inevitably become soiled it is well to bandage the part after the inunction.

Accessory Cutaneous Methods.—These may be occasionally useful in special cases, and therefore deserve mention.

Mercurial Plasters.—A certain though small amount of mercury is absorbed by the skin when plasters containing it are maintained in apposition to its well-cleansed surface; and Quinquaud has attempted to use the drug in this manner for systemic medication. Entirely too little, however, is thus absorbed, and the method is useless, except in the case of infants. The infant's skin is far thinner, more delicate, and more absorptive than that of adults; and the dosage that they require

is far less. I frequently employ it in heredosyphilis, though even here it is rarely enough alone, and has to be supplemented by inunctions or mouth administration of the drug. The official white precipitate ointment, or a mixture of that with mercurial ointment, 1 to 1, 2, or 3, is spread thickly on a cloth and adjusted under the bellyband.

Mercurial Baths.—This method was much in use at one time; I employ it only for infants. A wooden tub must be used; and to one of ordinary size and filled with water, 20 to 30 grains of bichloride of mercury, with an equal amount of ammonium chloride, dissolved in water, is to be added. In this the child is placed for ten or twelve minutes, care being taken of the hands and face so that none of the poisonous fluid reaches the mouth. I have seen excellent effects from these baths, which have a local action on any dermal lesion that may be present, as well as a systemic one.

Mercurial Fumigations.—These have fallen into desuetude on account of their troublesomeness and uncertainty, and because of the serious poisonings that have happened from their use. I have used them a few times, however, in the City Hospital, in bad and neglected cases where there were extensive condylomas or ulcerative processes around the genitals, and where local dressings would be very troublesome. From 30 to 60 grains of calomel are vaporized under the patient, who is seated on a stool chair, and has blankets wrapped tightly around his body and neck.

Mercurial Flannels, Mercolint Aprons, etc.—Welander has proposed the use of a flat bag impregnated with mercury to be worn next to the skin on the chest. Comparatively little of the drug is absorbed by the skin, but an appreciable amount of the vaporized metal is inhaled. These so-called mercolint aprons are obtainable, and may be occasionally employed in mild or quiescent cases in which, for one reason or another, the ordinary methods of medication are inapplicable. Similarly mercury-impregnated cushions for the patient to sleep on every night have been prepared by Merget.

Administration by Injection.—About half a century ago this mode of administering the mercurial medication was first practised by Hebra and Kaposi, who used the sublimate; and almost at the same time Scarenzio gave the first injections of an insoluble preparation, calomel. For a long time, however, the method was but little used. Prejudice in favor of the easier mode of buccal administration made that the route most used in the English-speaking countries; and even today an overwhelming majority of the cases in America and England are treated in this way. In Germany and Austria inunctions are probably most employed, that being the method preferred by the Continental teachers of the last generation. The last fifteen years, however, have seen a great change in this respect; and it can safely be said that today the great majority of syphilologists the world over employ the hypodermic method by election, and the general profession is largely following their lead.

The reasons for this are many and obvious. There has never been the least doubt at all that from the therapeutic standpoint alone the introduc-

tion of mercury into the system by placing it under the skin, or in the muscles, or in the veins, is the quickest, most effective, most exact, and most thorough method of administering the drug. Objections have been urged against it, and, as with every other powerful medication, with justice. It has some disadvantages, but the arguments in its favor are so many and so cogent that the former lose much of their weight.

In favor of the injection methods are, in the first place, the fact that in no other way can the disease be so effectively combated. Not only do the ordinary symptoms yield as they do to mercury otherwise administered, but recalcitrant phenomena of the most serious character disappear under their influence even when obstinately resisting other methods of exhibition. No other mode is so quick in showing results, a factor of the greatest importance when organs like the eye or the brain are threatened by the disease. In a space of time so short that it must be measured by minutes the entire system can be impregnated with the drug, and the spirocheta be combated in the innermost recesses of the organism. Manifest objective improvement occurs in skin lesions in a day or two; but it is by means of subjective symptoms, as seen by skilled observers, that the rapidity of effect is most manifest. Thus, one of the commonest and most distressing of the symptoms of the early infection, the persistent cephalalgia, will often begin to remit a few minutes after an effective injection, though it may have been present continuously for days and weeks. I have often taken pains, when this symptom was present in an infected physician, to ask the patient to note with accuracy the exact time when improvement began; and I have often been told that amelioration began fifteen to twenty minutes after the injection, and was very marked within an hour.

Other good points are the entire protection of the gastro-intestinal tract from irritation; the possibility of exact dosage, since all the mercury that is introduced into the body is used; and the great rarity of general intoxication or of local bad effects, such as stomatitis or salivation.

From the patient's point of view the injection treatment has many and obvious advantages. There are no medicines to be taken at regular hours to betray him to those who need not know of his misfortune, or to be forgotten and neglected during the long periods of apparent good health. He receives his medication at the physician's office at regular intervals, and between times he can forget what has happened to him. I am often told spontaneously by patients that they much prefer the regular infrequent visit for medication to carrying around pills or fluid medicines to be taken surreptitiously at frequent intervals.

From the standpoint of the physician the method is eminently satisfactory. The treatment is entirely in his hands; the patient is kept under close observation; accidents may be obviated or appropriately handled at their start; and the whole case can be managed in a manner that is as much superior to that of giving a prescription and then leaving the patient to his own devices as is that of having the patient under control in a hospital to ambulant treatment of a case in a dispensary.

The objections to the injection treatment are some of them real,

while others are theoretical or imaginary. There is some pain connected with the injections; indurations, infections, and other accidents may occur, but these are mostly dependent on the method employed and on the operator, and can be almost entirely obviated with care. Serious accidents occur in a proportion of cases so infinitely small that their consideration may be neglected; I have not met with one in many tens of thousands of injections. All these things vary with the form and method of the injection treatment, and will be more fully considered below.

The injection method, then, is the modern method of election in the treatment of syphilis. I employ it, and have employed it habitually in at least 95 per cent. of all cases that have come under my observation for many years past. My experience is that most patients submit to it readily, and that intelligent patients prefer it to other treatment. The brief account given above of other modes of administration is for use in cases in which the injection treatment cannot be employed. Such cases are, in general:

1. *Infants.*—Here I rarely use it, for obvious reasons. Objections on the part of the mother to the apparent severity of the treatment; the marked receptivity of the infant's skin, which renders medication by baths or ointments so effective; and the delicate texture of the skin and muscular tissue, together with its proneness to react severely to injury; these considerations lead me to employ other than injection methods in most cases. Nevertheless, I have used them in a few very severe and apparently hopeless cases of heredosyphilis, with good effects.

2. *Occasional Extremely Sensitive Patients.*—We have all met with the patient who faints when an acne pustule is opened; and once in a very long time a patient, more often a man than a woman, complains so bitterly of the pain of the puncture that the treatment has to be changed.

3. *Extremely Thin Individuals.*—Once in a while a patient is so very lacking in subcutaneous adipose tissue, and his muscles are so small in mass, that the intramuscular injections, more especially, are hard to give. The damage done to the tissues, though small, is so great compared to their mass that the resultant discomfort is excessive, and the method of administration had better be changed.

As regards the injections themselves a clear distinction must be made between those that are of soluble mercurial salts, readily absorbed, frequently given, and generally administered subcutaneously, and insoluble ones, more lasting and less frequently administered, and given in the mass of one of the larger muscles of the body. A separate consideration of these two methods of the hypodermic administration of mercury will be necessary. The intravenous medication is not considered here as being entirely too troublesome for general use.

Soluble Injections.—This is perhaps the most active and vigorous mode of administering the drug, and can be employed in emergency or whenever an immediate and intense mercurial medication is indicated. It is not my method of election, and for the following reasons: The salts must be injected very frequently, every day or every other day, and for long periods. Thirty injections is a usual course; and this involves a

considerable strain on the sufferer's time and resources. Few of our patients will submit to it willingly. And whether the drug be administered subcutaneously or intramuscularly, there is a good deal of pain unavoidably inflicted; in some cases this is so great that the patient objects absolutely to a continuance of the treatment; and in any case infiltrations are frequent, and the course is quite a severe tax on the patient's fortitude and patience. I employ the soluble injections occasionally only, when an important organ is imminently threatened, as when a violent iritis occurs, or a gumma of the palate threatens perforation. The treatment has the advantage, of course, of keeping the patient under constant and careful observation.

A multitude of the soluble mercurial salts have been employed in this manner; all of them are more or less efficacious, and each has its special advocates for reasons that I do not consider sufficient. The bichloride, biniodide, benzoate, cyanide, oxycyanide, peptonate, lactate, cacodylate, etc., have all been used. I shall consider here only the bichloride, the biniodide, and the benzoate of mercury.

The Bichloride.—This is probably the most commonly used of the soluble salts; it is extremely active as a medication, but unfortunately it is very painful, whether administered subcutaneously or intramuscularly, and is prone to occasion stomatitis and diarrhea. I have found no advantage in using a normal saline solution as the menstruum, but use the following simple formula:

R—Hydrarg. chlor. corros.	gr. j
Glycerini	ʒi
Aquæ destillatæ	ʒiij

Ten minims of this equals $\frac{1}{24}$ of a grain; this is an average dose, and the quantity permits ready regulation within the usually requisite limits.

The Biniodide.—I agree with Audry in preferring an aqueous to an oily solution of this drug; iodide of sodium is used to promote solubility, and thus forms a double iodide of mercury and sodium. A convenient formula is the following:

R—Hydrarg. biniodidi	gr. j
Sodii iodidi, C. P.	gr. j
Aquæ destillatæ	ʒiv

The dosage of this is the same as that of the bichloride. I have found it less painful and equally efficacious. It is, however, open to the same objections as the former drug, in requiring frequent administration and being liable to cause gastro-intestinal and buccal troubles.

The Benzoate.—This has been advocated especially by Gaucher, and is probably the least painful of the active soluble preparations, especially when a little cocaine hydrochlorate is added to it. It may be prepared as follows:

R—Hydrarg. benzoatis	gr. j
Sodii chloridi.	gr. j
Aquæ destill.	ʒiv

The dosage must be a little larger than that of the other soluble preparations, for it is less efficacious than either the biniodide or the bichloride.

All the soluble mercurial preparations must of course be administered by means of an all-glass syringe, and if possible with an irido-platinum needle. Steel is quickly attacked by them, so that not only are the instruments employed soon ruined, but the injected salt itself undergoes change.

Insoluble Injections.—The injection into the muscular tissues of insoluble mercurial salts is by far the best method of administering the drug, and as it is the one that I habitually employ in the treatment of the disease I shall consider it in detail.

Scarenzio was the first to use calomel by injection in the treatment of syphilis, and he and his successors, employing it in large doses, obtained results, it is true, but at the cost of intercurrent effects that were often disastrous. Abscesses, general mercurial intoxications, stomatitis, intestinal troubles, and albuminurias occurred; and even fatal cases of mercurialism were recorded. The method fell into disrepute, and was long neglected until it was revived by Lang, Lewin, Barthélemy and others. Its extensive employment by syphilographers all over the world has demonstrated conclusively that its apparent disadvantages were due to faulty dosage and technique; and that, properly employed, it is the most effective, easy, and rational method of curing the disease. I have used it now as my usual method for nearly fifteen years, both in public and in private practice. The number of injections given yearly by my assistants and myself reaches many thousands; serious accidents are practically unknown, and even trivial ones do not occur if a proper technique is observed. The objections made to the method come from two sources. In the first place they come from those whose accidents have occurred from carelessness or impropriety in technique, and in the second place from those whose minds are still filled with the old records of failure and disaster that date from the middle of the last century. Of the various insoluble mercurial salts that have been employed, the three most important are calomel, gray oil, and the salicylate of mercury.

Calomel.—I employed this preparation for several years, giving it up finally for the salicylate; it is still used by many who prefer the insoluble injections. The oily suspension which was my earlier formula has been abandoned on account of the tendency of the drug to accumulate and cake in the bottom of the bottle, rendering resuspension by shaking a matter of difficulty, and making the dosage uncertain. As the salt is a heavy one, water alone does not hold it sufficiently long in suspension, and my final formula was the following:

R ₃ —Hydrarg. chloridi mite	1 grain
Glycerina purificat.	5 drops
Aquæ destillat.	5 drops

Calomel is extremely efficacious as an antisypilitic remedy, but it has some marked disadvantages. It is painful, and the various means

that have been suggested to obviate this unpleasant feature have not proved successful. The most practical of them is the addition of orthoform in about the same proportion as the calomel to the suspension. This somewhat mitigates the discomforts of the injection itself, but is useless for that coming on twenty-four or forty-eight hours later, which is much more marked with calomel than with the salicylate or the gray oil. With calomel, also, the rare but disagreeable accidents of the mercurial medication, and more especially salivation, are more prone to occur than with the other insoluble salts.

Gray Oil.—This is metallic mercury in an extremely fine state of subdivision, and suspended in an oily menstruum. Its chief advocate has been Lang, by whom and others it has been very extensively employed. Its use is undoubtedly one of the most effective means of mercurial medication that we possess; but unfortunately its value depends greatly on the menstruum that is employed and the care and pains expended on its preparation. Everything seems to depend on the degree of “extinction” of the metal; and this depends on the specific gravity of the menstruum and the time and labor expended on its elaboration. Gray oils in which the comminution of the metal has been pushed to the limits of extinction are most active therapeutically, and also the most toxic and the most painful. On the other hand, gray oils less carefully prepared are more liable to be encysted, and to accumulate, with the dangers of a massive late absorption. Besides this the preparation is not very stable. Lang says that if preserved in a cool place it can be used for “some time.” This authority’s recipe for the preparation of the injection fluid is as follows:

R—Hydrarg. depur.	3ij
Axung. porc. recent.,	
Sebi ovil. recent.	ss 3i
Fiat extinct. perfectissima.	

Two parts of this ointment are to be rubbed up with three parts of pure olive oil, making a gray oil containing 20 per cent. of mercury, the usual dose being two to five drops. Great care is necessary in the preparation of the injection fluid, all the utensils employed being carefully washed with a warm soda solution immediately before employment, and the syringe being subjected to the same treatment. And as sterilization of the finished product by heat would injure the perfection of the emulsion, all the materials must be sterilized separately beforehand.

Gray oil injections are well borne, but there are certain objections to it which have prevented its employment here to any extent. Great care is required in its preparation, and it is not very stable. Accidents, some very serious, have been reported from its use, though probably, as is the case with the salicylate, they have been mostly due to careless or faulty technique.

Salicylate of Mercury.—This has been for a long time my favorite and standard preparation in the treatment of syphilis, and the experience of years has confirmed me in my choice. I shall therefore describe in

detail the technique of the injections as the method that I habitually employ and recommend for the treatment of the luetic disease. The salicylate has all the advantages of calomel and gray oil, while it is much better tolerated and much less liable to accident. It is easily prepared, and keeps indefinitely.

1. *The Injection Fluid: Its Preparation and Properties.*—The salt used is the insoluble basic salicylate of mercury; not the neutral salt, which is soluble; it contains 59.52 per cent. of metallic mercury. I no longer use watery glycerinized suspension fluids, but employ an oil. The organic oils are unsuitable, as they are variable in composition and liable to decompose; a mineral vaseline oil, or a combination of them of varying specific gravity, is far preferable. The product commercially called albolene is of about the right consistency; but if desired, one of the heavier vaseline oils can be used.

The suspension should be carefully made, for if the comminution and mixture is not thorough, the larger aggregation of the insoluble salt renders the mixture less stable after shaking, and so makes the injection technique less easy; the larger the particles the more liable the lumen of the needle is to get clogged; and I am very certain that the discomfort to the patient is increased. The oil should be added in very small quantities at a time to the powder in the mortar; abundant time should be taken and plenty of rubbing up employed. As any desired amount can be made up at once, the preparation keeping indefinitely and nothing but the ordinary skill and care required, there should be no complaints, as I have had them come to me, of lumpiness of the preparation, hard settling in the bottom of the bottles, etc.

It is convenient to have the emulsion put up in the ordinary small-mouthed half-ounce vials, the orifice of these being just of the right size to fit the head of the syringe to be described later; any required amount can be drawn into the instrument by inverting the bottle, and without the loss of a drop. A wider-mouthed bottle necessitates the plunging of the instrument into the fluid, which, though it does no special harm, if this latter is clean, is undesirable. As the amount used for each injection is ten drops or less, half an ounce suffices for at least twenty-five injections.

Sterilization of the suspension is effected in the following way. A sufficient number of new bottles and corks to hold the amount made are sterilized by boiling and permitted to drain and dry. Each bottle is then filled up to the neck with the well-shaken suspension and corked with a pledget of cotton. The filled and plugged bottles are stood up in a water bath filled with fluid to the height of their necks, and the water is then gradually brought up to a slow boil, and kept in that state for half an hour. The bottles are then taken out of the bath and stoppered with the sterilized corks; the heads of the bottles are then dipped into melted paraffin to seal them perfectly. I have attempted in the past to have the preparation put up in sealed ampullæ, and a French preparation of the kind is on the market. But I found the bulbs so small and the amount of material so little that it was very difficult to shake up the con-

tents to form a perfect emulsion. Besides this, it is a very expensive and entirely unnecessary refinement of technique.

Once sterilized and bottled the suspension requires no further attention. It remains absolutely unchanged for years. Neither the mineral oil nor the salt afford material for microbic growth. I habitually keep several bottles in use at one and the same time, without any regard to the age of the suspension. For experimental purposes I have left a full bottle uncorked for months at a time; microscopic examination has shown that with the exception of a layer of dust and microorganisms on the surface the fluid was absolutely unchanged. With ordinary care there is no chance of contamination of the injection fluid, and it can be used when required without any further preparation.

The formula that I now employ is the following:

R—Hydrargyri salicylat.	3j
Alboleni	3ij

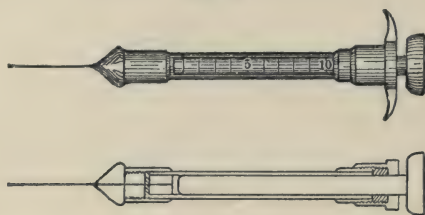
This makes a 20 per cent. suspension. I formerly used a 10 per cent. mixture, but I found that many cases required so large an amount of this that a heavier mixture was advisable. The amount of tissue disturbance and irritation caused by the injection is largely dependent on its mass, and it is advantageous to make that as small as possible. Of course, the thicker suspension slightly increases the technical difficulties of the injection; the needle is more liable to become plugged during the operation; and the manipulations must be done somewhat more rapidly, on account of the larger and heavier mass of solid material. These difficulties can be obviated, however, by correct technique, as will be explained later on.

2. *The Syringe and Needle.*—Any hypodermic syringe can be employed, even one composed entirely of metal. The insoluble salt in the mineral oil does not attack metal, no matter how long it may be in contact with it. Even the end of the solid metal plunger in the syringe that I use, which is never cleansed of the solution and remains permanently coated with it, does not lose the polish from its nickelled surface. But the barrel of the instrument employed must be of small caliber, so that the dosage can be measured by drops; it should be of glass, so that the condition of the injection fluid can be observed; and it should have a slip fitting for the needle, so that the latter can be readily detached during the progress of the injection.

The syringe that I use is of a model that I had made some time ago, and which is obtainable from the surgical instrument makers. The barrel is made of accurately calibrated thermometer glass, graduated in drops, and sufficiently narrow to make each drop measure about $\frac{3}{16}$ of an inch in length; thus, the injection fluid can be seen, the presence of air-bubbles, etc., avoided, and accurate dosage to a fraction of a drop be given. The piston is a solid metal rod, so that there is no trouble with washers or piston rings, and the injection fluid comes in contact only with glass or metal. The head of the piston is in the form of a broad flat disk for two purposes: its weight gives solidity to the instrument in

making the rapid plunge of insertion, and its large flat surface permits the filled and prepared syringe and needle to be stood up out of the way of harm or contamination while the patient's skin is being prepared for the injection. The needle end fitting is so made that it fills up the entire lumen of the tube and fits accurately up against the end of the piston when the syringe is empty; and its outer end has a round slip fitting for the needle. The head end fitting has a single washer against which the barrel end is screwed; that is the only thing not metal or glass in the whole instrument, and as it is placed between the upper end fitting and the barrel top it does not come in contact with the fluid in the syringe. A small pair of arms on the head fitting facilitates the handling of the instrument.

FIG. 17



Author's syringe for the hypodermic treatment of syphilis.

The needles are of the regular antitoxin size caliber, and for ordinary use should be one and one-half inches long. This is sufficient in most cases to reach through the skin, subcutis, and fat into the muscular tissue; but women have a great deal of adipose tissue in the region of the buttocks, where the injections are almost invariably made, and for them a two-inch needle of the same caliber should be used. A needle insufficiently long, or not introduced to the hilt, may lead to the deposition of the mercurial salt in the subcutis instead of into the muscle, in which place it is more irritant and more liable to cause the formation of tender infiltrations.

The syringe itself need not be sterilized, and it certainly should not be boiled, this latter destroying the calibration and loosening the cement that attaches the glass barrel to the metal heads. The extremely tenuous space between the sides of the piston and the inner wall of the glass barrel remains filled with an extremely thin layer of the sterile emulsion, and the barrel, when driven home, fills both extremities of the tube closely. The only portion of the instrument that comes in contact with the injection fluid and is liable to be contaminated is the slip-joint of the needle end of the barrel, and this can be sterilized before injection by passing it once or twice through the flame of a spirit lamp or Bunsen burner. The use of alcohol or ether to dissolve the oily matter and of boiling water to sterilize the syringe is entirely unnecessary and destructive.

Pretty much the same holds good for the sterilization of the needles. I use a separate needle for each patient, keeping each in an appropriate

small pasteboard box, with the patient's name on it. Before making the injection the needle and the stylet are passed two or three times slowly through the alcohol flame. This is quite sufficient to destroy any infective material (including spirochetæ) that may be on the outside. Inside the needle there is only the injection fluid, and, of course, being safe from contact with external objects, infection could not occur from it. It is quite unnecessary to prolong the passage through the flame to the extent of taking the temper out of the needle. When that occurs, as it does occasionally, the needle simply bends instead of breaking when subjected to undue strain. My needles last practically indefinitely.

One additional precaution should be mentioned—see that the needle points are in good condition and sharp. Much of the success of a painless injection depends on this, and I have a small whetstone on hand, and often resharpen my needles before sterilizing them.

3. *The Injection Site and its Preparation.*—The insoluble injections are given deep in the muscular tissue, and there are only two places in the body where the muscle mass is sufficiently great to render the amount of tissue disturbance negligible. I have tried the large muscles over the shoulder-blades a number of times in the attempt to obviate the inconveniences sometimes experienced from the use of the gluteal site, but I have found that the patients complained that they were uncomfortable when lying in bed or when using their arms. I now use only the gluteal site.

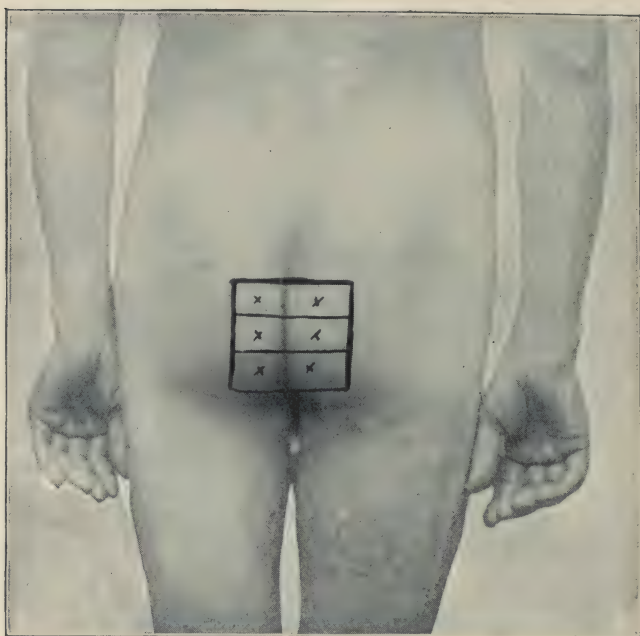
The area to be employed is the muscle mass between the trochanteric fossa and the middle line, giving an area with a superficies of at least six by four inches, even in cases with poorly developed glutei. This gives at least six distinct injection sites, three on each side; so that even if the injections have to be given with unusual frequency it is several weeks before it becomes necessary to revert to a location once used.

The accompanying diagram (Fig. 18) shows the area to be employed, and by a systematic use of each subdivision the best results are attained. It is a mistake to use the side of the buttock, and still more one to inject over the trochanteric area. The insoluble mass when put into muscle closely covered by dense connective tissue near the insertion of the muscles in the bone causes pressure, and discomfort necessarily ensues. The direction of the needle should be downward and outward, since in that direction the centre of the muscle mass is best reached.

The skin must be carefully cleansed and sterilized, for the risk from infection is greater from that than from any other source. Any method may be employed, but the one that I habitually use is expeditious, and I have not known it to fail. The single infection that I have seen in many years was in an injection given at a consultation in the dark bedroom of a tenement house and without any proper cleansing. The skin is scrubbed with carbolyzed water and a piece of sterile gauze, and then the process is repeated with a liberal amount of ordinary commercial ether. This latter not only removes the fat and detritus from the surface of the skin, but acts by the cold induced, as a local anesthetic. The pain of the puncture, properly made, is almost none.

4. *The Injection.*—I almost invariably make the injection with the patient standing upright and the feet close together. The glutei are thus in the best position, and it is an advantage that the patient is unable to see what the operator is doing. The quicker the manipulations of introduction and withdrawal of the needle is effected the less the patient feels during the injection, and with practice a rapidity of execution is attained that greatly facilitates the process. The needle is sterilized by passing it through the flame, and set up on end, and the stylet is included in this process, as it may be necessary to employ it during the course of the injection. The emulsion is thoroughly shaken up, the syringe filled

FIG. 18



Sites for the mercurial injections. (Gottheil.)

with it, the needle put in place, and enough of the fluid pressed out to remove all air-bubbles, etc. The instrument is then set up on its broad head, so that the point and shaft is safe from contamination, and the injection site is rapidly prepared. The syringe, held like a penholder, is then plunged rapidly and forcibly up to the shoulder of the needle into the site selected.

And now comes a point in the manipulation that is of vital importance, and must under no circumstances be neglected. The commonest untoward happening from the injection is the propulsion of the oily fluid into the venous circulation, due to the point of the needle being in the

lumen of a vein. Fat embolism of the pulmonary vessels is a disagreeable occurrence, though hardly ever a serious one; it will be considered below. It can always be avoided by stopping after the needle is introduced, detaching the syringe, and closely watching the lumen of the needle in the tissues. This latter is filled with a column of emulsion, and capillary attraction causes the proximal end of this column in the needle cap to assume a concave shape. This concave fluid dome should be narrowly watched for ten or twenty seconds, the slightest bulging forward and inversion of the fluid cap, not to speak of the flow of the injection fluid followed by blood from the needle, shows the presence of a *vis a tergo* that can only be the blood pressure in the vessels. No injection is to be made at that site, the needle is withdrawn, and a new insertion is made.

Traversing of bloodvessels by the needle during its course through the tissues is of no account at all; only when the lumen is continuous with a blood channel does embolism occur. Hence a flow of blood from a puncture after an injection need cause no concern; it stops with a little pressure by means of a pledget of cotton.

The needle location having been found safe, the filled syringe is re-applied; and it is here that the advantage of the slip over the ordinary screw-top of the instrument is shown; the manipulations of detaching and reattaching the needle can be done quickly and easily, and without disturbing the location of the needle point. The injection is then made slowly and steadily; then the entire instrument is withdrawn as rapidly as it was plunged in. At the moment of withdrawal the orifice in the skin is closed with a pledget of cotton and a bit of zinc oxide plaster applied over it. This latter need remain on only a few hours.

Massage of the injection area after the operation I have abandoned entirely of late years, for I have not found that it mitigated any discomfort that occurs afterward, or in any way influenced absorption. On the other hand, it might happen that the spreading of the emulsion might force some part of it into a vessel wounded by the passage of the needle.

As above stated, there is practically no pain at all at the time of the injection, provided the operation is expeditiously and properly performed. A few hours after, and lasting possibly for a few days, there is a bruised and tender feeling that patients liken to a kick or blow in the gluteal region. A hard induration sometimes remains at the site for some time, but this is usually due to one of two causes. The injection emulsion has been carelessly prepared, so that the solid matter is not in proper suspension, leading to the deposition of larger masses of the salicylate in the tissues. Or the needle has been too short, and the emulsion has been deposited in the fatty tissue and not in the muscles; under which circumstances it is much more irritant and much more likely to form a slowly resolving indurated mass.

Finally, and more especially with the 20 per cent. suspension that I now employ, the needle may become clogged with the salicylate during the progress of the injection. The quicker the manipulation of the injection, and the more perfect the emulsion, the less likely is this to

occur; it hardly ever happened to me with the older 10 per cent. suspension; occasionally I encounter it with the new one, which is one-fifth solid matter. It is for this reason that I always flame the stylet with the needle; when clogging occurs the syringe is detached from the needle and the stylet introduced into its lumen to push forward the obstruction and free it.

5. *Difficulties and Dangers of the Mercury Salicylate Injections.*—Much stress has been laid upon untoward effects from this form of administration, largely either on theoretical grounds or from occurrences of long ago, when the technique was still imperfect. The chief objections have been the following:

Pain.—This is distinctly less marked with the salicylate than with calomel, and is one of the reasons that have led me to substitute it for the latter drug. The injection itself is practically entirely painless, provided it is done with moderate skill, and properly. Of course, if the needle is blunt, the insertion slowly and hesitatingly made, or the surface sensation not blunted by cold, there is more or less pain with this as with any other procedure involving puncture of the skin. But the gluteal integument is not sensitive, and I have no hesitation in saying that in most cases the patient hardly feels the puncture at all.

The secondary discomfort or pain is a different matter. There is necessarily some of the former; it is impossible to inflict such an injury to the muscle mass as that occasioned by the deposition therein of the suspension without some discomfort. This begins a few hours after the injection and lasts two or three days. In most cases, however, it is moderate, being limited to a bruised feeling in the buttock when the injection site is pressed upon, as in sitting in a certain position. Personal idiosyncrasy naturally plays a great part; once in a great while we inject a patient who complains greatly. The larger the glutei and the fat around them the less the discomfort, so that women, as a rule, are excellent subjects, and rarely complain of the injections. Improper implantation may cause unnecessary discomfort. The use of a needle that is too short in a stout individual causes deposition of the emulsion in the subcuticular connective tissue instead of in the muscle mass, and it is always more painful there. This is even more certain to occur if the injection is made over the trochanter, as I have seen it done, so that the insoluble material is placed under dense fasciæ where the least swelling causes discomfort.

Local Inflammatory Reaction.—This occurs, in a certain proportion of cases, in spite of all precautions. A hard, more or less tender, indurated mass forms, which persists for a number of days. It is rarely troublesome, however, and soon recedes under the influence of hot applications or hot sitz baths.

Infections.—These, of course, do not occur under proper aseptic procedures.

Fat Embolism of the Lungs.—This is a distressing and apparently serious occurrence, marked by the occurrence of sudden and severe coughing, pain in the side, blood-stained expectoration, etc., but no serious results occur, and the symptoms gradually recede in a few hours.

It need never occur, however, if the precautions detailed in describing the injection method are observed. In one clinic in this city, where these are not observed, I have been informed that embolism is of fairly common occurrence, and is not regarded as an accident of any seriousness.

Intoxications.—Mercury is a poison, of course, and its administration in efficient dosage in any form can never be a matter of indifference. Idiosyncrasy to its effects, though very rare, may be present in any case, and severe and even fatal intoxication has occurred from buccal administration, inhalation, and inunction of the drug. These cases are so infrequent, however, in view of the many millions of instances in which it is administered, that they may be left out of account. I always observe the precaution, however, in a new case on whom the action of the drug is not known, and when there are no symptoms of immediate urgency requiring a large dosage, of making the first amount administered a small one, say one-half the average dose.

In this connection one theoretical objection of apparent cogency may be noted. It is claimed that a dose of the insoluble salt having been injected, control over the medication is lost so far as that amount is concerned, and nothing short of a surgical removal of the injection site will prevent the further absorption and continued action of the mercury. Of course, knowing as we do the long-continued presence and action of mercury in the body, however administered, the same holds true of other modes of giving the drug, though perhaps to a less degree. But the fact remains that intoxications from the injected drug are extremely rare. When a severe salivation does occur it runs a course precisely similar to salivation incident to other methods of administration; and I have never yet had occasion to have to resort to any radical measures to remove a mercurial focus from the organism.

Local Gangrene, Sloughing, etc.—This is mentioned because it is still occasionally referred to by objectors to the injection method. It does not occur today, and the cases cited date from the times when very large doses of calomel were injected without antiseptic precautions.

Iodine.—Iodine has not been employed nearly so long as mercury in the treatment of syphilis, its use dating really from the time of Ricord in the middle of the last century. It is not, like the latter drug, a specific medication for the infection itself, but it has been found to be of indubitable use for certain of its manifestations, more especially for the proliferating, infiltrated, degenerative lesions that mark the later stages of the disease. It is employed more especially for the lesions designated as gummatous, whether of the external integument or the internal organs. It is a mistake to consider it, as is frequently done, as of equivalent value with mercury, for while this latter directly counteracts the microbic organism that is the cause of the disease, and is applicable to it in all its stages from the earliest to the very latest, iodine is useful only in certain forms of the affection and its effects, and even then is best administered in conjunction with the real specific medication.

Action of Iodine in Syphilis.—The manifest efficacy of the iodic medication in the later manifestations of the luetic disease has led to its

general employment in all stages, and it was soon found that it was useful even in some of the very early cases. The schematization that has caused the phenomena of the disease to be generally divided under the heads of primary, secondary, and tertiary manifestations has undoubtedly been useful, but it is generally recognized today that the division is an arbitrary one, and the cases belonging in point of time to any one of these divisions may show phenomena and require treatment appropriate to another. Hence, some quite early lesions may react well to the iodic medication.

The curative action of iodine in syphilis is exhibited on all infiltrated, proliferated, and degenerative lesions, no matter at what time they appear. Hence it is to be employed chiefly in the late secondary and the tertiary stages and in the postsyphilitic and parasymphilitic affections. Wherever in the course of the disease there are large cell accumulations it will be useful, and it is also to be used for its prophylactic action. It is a matter, of course, that is not susceptible of direct proof; but in view of the direct beneficial effect of the medication on the proliferative lesions when found, it is reasonable to suppose that it will have a similar action on beginning and undiagnosed accumulations of similar nature, more especially in the internal organs. And since the iodic medication, properly conducted and safeguarded, is harmless, I approve of the custom of giving a certain amount of iodine, together with the specific mercurial medication, in the later stages of the disease, no matter whether there are special symptoms calling for its employment or not.

In all probability iodine and the iodides have a beneficial action in syphilis in the following two ways. In the first place they increase the activity of the lymphoid tissues, thus helping to rid the organism of cellular detritus and parasitic and infectious organisms. And in the second place they energize the processes of nutrition, increase combustion, and render disassimilation more active. They undoubtedly help the organism to rid itself of pathological cellular infiltrations.

The Absorption of Iodine by the Organism.—Iodine in solution is readily absorbed by all the mucous membranes, and more especially by that of the gastro-intestinal canal. It is also absorbed by the cellular tissue when injected hypodermically. Through the unbroken integument it can hardly be introduced into the system at all. Its course in the system is still a matter of doubt. It probably suffers some kind of decomposition, possibly a simple one, with the chloride of sodium of the blood.

The Elimination of Iodine by the Organism.—In contradistinction to mercury, iodine is very rapidly passed through the system. It appears in the urine, saliva, mucous secretions, bile, milk, etc., within half an hour after its administration, even by the mouth. The kidneys, however, are the chief emunctory, and Desprez has shown that 60 to 70 per cent. of the given dose can be recovered from the urine. Most of it has passed through the body in twenty-four hours, but delicate tests show minute traces of it in the urine for a number of days. Renault believes that this extreme rapidity of elimination explains the energy of its action on cellular infiltrations, and its small effect on the infection itself.

Iodic Accidents.—*Iodism.*—Most of these are not serious, though they may be inconvenient enough to render it necessary to suspend the medication for a time or permanently. The *iodic acne* is a fairly constant phenomenon, but is, of course, merely an inconvenience and a disfigurement. The *coryza* is more troublesome, but unimportant, save when, in exceptional cases, there are general catarrhal symptoms, with fever, etc., a true iodic grippe. *Gastro-intestinal difficulties*, nausea, vomiting, anorexia, are of more serious import, not only on account of the subjective distress that they occasion, but also on account of the bad effect that they have on the patient's general nutrition. *Cutaneous eruptions* are liable to occur; of the commonest is a *purpura* of the lower extremities, which has no special significance. Very rarely, however, *pustulocrustaceous*, *bullous*, or *vegetating iododermata* ensue from the iodic medication; these are serious occurrences, and are indications for an immediate cessation of the treatment. I have recently reported a case (affected with chronic nephritis, it is true, as well as with syphilis) in which the iodide of potassium occasioned a hemorrhagic bullous eruption that terminated fatally. *Edema of the glottis and of the lungs* has been seen in a few cases.

Iodine is so useful, however, in the cases to which it is suited, and the proportion of ill effects is so small, that these occurrences cannot prevent its use. Their effect may be diminished in various ways. The rectal or the hypodermic method of administration may be employed when the stomach gives out; different iodides may be tried when one disagrees. I have not seen much benefit from attempts to mitigate the ill effects of the iodine by the use of bicarbonate of soda, belladonna, etc. One important point, however, must be remembered. Many of the iodic by-effects, especially the more innocent ones, as the acne or the coryza, are more marked from the smaller beginning doses than from massive ones. A patient will often complain greatly of 60 grain daily doses, while his complaints will soon cease when the dose is pushed to several hundred grains per day. While this must not, of course, be done in the exceedingly rare cases in which the more serious by-effects are seen, it will often enable us to administer an effective iodic medication in cases that affirm that they cannot take the drug. And, as will be seen later on, an effective iodine treatment is a very different thing, as regards dosage, from that generally used.

Iodine Preparations and Their Administration.—Iodine may be administered by the mouth, per rectum, or subcutaneously. Since, however, there is not that difference of effect from different methods of exhibition and from different preparations, as is the case with mercury, and since the iodic medication, as a whole, is of greatly less importance than that of the latter in the syphilitic disease, I shall proceed at once to a consideration of the various preparations employed.

Potassium Iodide.—This is the drug generally used, and it is undoubtedly the most effective of the group. By far the best form to use it in is in a watery solution, and since the so-called saturated solution varies a good deal, it is better to prescribe it in a 50 per cent. solution in dis-

tilled water, which can be administered in drop doses. It must be well diluted with water and administered after meals, in order that it may become mixed with the food in the stomach, and thus avoid irritation of the gastric walls as much as possible. One important caution applies to this as to all the iodides: it must not be administered in the same formula or at the same time as any of the protosalts of mercury; chemical decomposition occurs, and the comparatively innocent protoiodide or protochloride becomes the poisonous biniodide or bichloride. If it is desired to administer the mercury and the iodine together the latter drugs in appropriate dose must be used, or if the protosalts are used, one must be given an hour before and the other an hour after meals.

Iodide of potassium often disagrees when administered by the mouth, but tolerance is usually established if the dosage is rapidly raised. If the stomach prove intolerant the rectum can be tried; that organ absorbs the drug very readily. The process to be employed is exactly that used for ordinary nutrient enemata. After a preliminary cleansing of the rectum, one to four ounces of a mixture of warm milk and a saturated solution of the iodide with a few drops of tincture of opium is slowly thrown in, and is to be retained. Considerable amounts can be administered in this way. In urgent cases, in which it is necessary that large doses be administered, stomach tolerance can be increased by putting the patient to bed, applying a mustard plaster or a fly blister to the epigastrium, and if necessary administering the medication with a stomach tube. I have more than once employed this method when the patient was unconscious or recalcitrant.

As regards the dosage to be used there is very prevalent error. I am frequently told that a patient has had a full dose or plenty of iodide of potassium and have found that this meant 30 to 60 grains a day. In a very large proportion of cases this dosage is entirely ineffective. A full dose of the iodide in any given case means either enough to make the symptoms recede, or to iodize the patient up to the limit of his capacity. One hundred and eighty grains a day is an ordinary dose, and several hundreds daily is not infrequently given in my wards in the City Hospital. Even these limits are sometimes exceeded. I have this summer had a patient there whose ulcerating gummata did not improve until a dosage of 1400 grains daily was reached; and in another, unconscious from meningeal gummata, 1200 grains daily were required, half being given by the stomach tube and half per rectum.

Sodium, Ammonium, and Rubidium Iodides.—The depressant action of potassium on the heart, and the endeavor to find a soluble iodide that would cause less gastro-intestinal irritation, has led to the employment of these salts. They are certainly less active than that of potassium, and are hardly any better tolerated. The dosage is the same, and since the rubidium salt is very expensive, its use in the doses required is almost impossible.

Organic Iodides.—A number of proprietary preparations are on the market, such as iodalbacid, iodone, iodothylin, sajiodin, etc. They are very expensive, and contain relatively small amounts of iodine: and as

iodic by-effects and iodic therapeutic action run side by side, their supposed innocuousness is due to the small proportion of the effective drug that they contain. Nevertheless, they have certain advantages due to the fact that they can be administered as solids in capsules or wafers; hence their mention here. Sensitive patients who object to the taste of the iodide solutions, travellers, etc., and others who have to take the iodic medication in small amounts for long periods of time may be put on one of them.

Iodipin.—This is the only iodide preparation used with any degree of frequency for injection subcutaneously. It is a combination of oil of sesame and protochloride of iodine, and is prepared in different strengths; the 25 per cent. strength is usually employed, two to four drams being injected between the shoulder-blades at a dose. The medication has given good results in the hands of a number of Continental observers, but I have not employed it. The indications for iodine are never so urgent as for mercury; almost all cases can take the remedy in one or the other form described above; and massive injections of a drug that is so readily eliminated as iodine, and that have to be done so often (for the iodipin injections have necessarily to be given every day or every other day), is a treatment that, in my opinion, is to be used only in cases of extreme rarity. I should employ it in a case in which late lesions immediately threatened life or some important organ, in which mercury alone was ineffective, and in which there was complete intolerance to iodine by the ordinary routes.

The Mixed Treatment.—This is the commonly accepted term for a therapeusis in which mercury and an iodide is given conjointly by the mouth. The two drugs may be given together, as in the following formula:

R̄—Hydrarg. chlor. corros. seu biniodidi	gr. j
Potassii seu sodii iodidi	ʒss
Syrup zingiber.	ʒj
Aquæ	q. s. ad ʒiv—M.
Sig.—ʒj dose.	

The objections to it are that the dosage of neither drug can be readily varied, as is usually required, and it is generally preferable to give them separately. The protoiodide or any other mercurial can be given in tablet or pill form, and the iodide in 50 per cent. solution and in varying doses, care being taken, if protosalts are exhibited, to have a sufficient interval of time elapse between the administration of the two drugs to prevent their encountering one another in the stomach. It is usual to give the mercurial before and the iodide after meals. The treatment is one that I rarely use, for reasons already detailed. Yet it may be necessary to have resort to it, as in the case of travellers or patients who can only be seen at longer intervals.

Arsenical Medication.—*Atoxyl*, *Dioxydiamidoarsenobenzol* ("606"). Arsenic has long been recognized as having a certain though undetermined value in the treatment of constitutional syphilis, in addition to its general tonic effect; but its toxicity and the fact that in mercury we possess a less dangerous and more effective drug to combat the spirocheta

have prevented its general employment. Recently, however, renewed attempts have been made to utilize the newer arsenical preparations of Ehrlich, which have proved effective in the trypanosomiasis, the organisms occasioning which seem closely related to that of syphilis.

Atoxyl.—This is essentially an anilarsenate of sodium, and has now been before the profession for a number of years; nevertheless, there is by no means accord as regards its availability. Hallopeau and others who have used it largely are greatly in its favor, while von Zeissl and syphilographers of equal authority consider it far inferior to mercury in its curative effects. It is best administered in a 10 per cent. sterile aqueous solution, ten to fifteen drops being administered hypodermically every other day for a varying period. Unfortunately, however, there are some drawbacks and some real dangers involved in its employment; and, though vaunted in the beginning as the ideal treatment for lues, it has steadily been losing ground, so that it is questionable today whether it will maintain its place in our antisiphilitic armamentarium.

In many cases, in the first place, it is entirely inefficacious; and in the second, relapses sometimes occur after its employment, with quite disconcerting rapidity. More serious, however, are the occurrence of serious gastro-intestinal trouble, renal irritation, and severe skin eruptions. Worst of all, however, optic atrophy and blindness have been occasioned in a considerable number of cases. Milian, among others, considers the undoubted good effects that have been observed in many cases as due to the arsenical medications per se, and that equally good results can be obtained from plain sodium arseniate; and that it is the poisonous aniline in the compound that is responsible for its serious ill effects. Personally, I neither use nor recommend atoxyl in the treatment of syphilis, though the future may give it a place as a remedy to be employed in extremely rare or desperate cases in which ordinary methods of medication have failed us.

Dioxidiamidoarsenobenzol.—No article on the treatment of syphilis could be considered complete at the present writing (October, 1910) without some reference to the new remedy which, under the popular name of "606," is exciting such interest in the medical world. This is the latest of Ehrlich's antiluetic preparations; great things are claimed for it, and many of them are apparently sustained by the reports of German observers. It is manifestly a matter of difficulty and danger to attempt to give a preliminary judgment on a syphilitic remedy that is only a few months old and has been used only in hospital cases. Years of observation on private cases that can be followed up will be required before certainty is reached. It is asserted that not only do the most serious manifestations of constitutional syphilis retrogress with marvellous rapidity, but that a single injection permanently destroys the spirocheta and cures the patient, though already these statements are being greatly modified by certain observers. I shall confine myself here to my own personal observations of its effects, based on seventeen carefully observed hospital cases. These cases included some of the severer as well as some of the milder cases of syphilis in all its stages.

The preparation is a proprietary one, and as it oxidizes very quickly, it comes in sealed vacuum capsules; the preparation of the emulsion or solution, for it is used in both forms, requires delicate chemical neutralization and prolonged centrifugation at a very high rate of speed, and the injection must be given within a short time of its preparation. The dose, administered subcutaneously between the shoulder-blades, was in almost all cases 0.6 of the drug in about half an ounce of fluid. There is necessarily a good deal of pain; the first night was almost always sleepless, and sometimes several nights; and a large tender induration remained for some weeks. In several cases kidney irritation ensued, as shown by the presence of red blood cells and hyaline and later granular casts, but these symptoms subsided in a few days.

The therapeutic results in these seventeen cases were not striking. In most cases the symptoms receded, but slowly; in no case could they be called brilliant. In four cases at least there were new manifestations of the disease after the injection, in two of them so serious that mercurial injection had to be resorted to. Relapse in a case treated three months ago was also seen; and these recurrent symptoms had not receded two weeks after a second injection. The drug in general had an unmistakable curative effect, but not more marked than that of calomel or mercury salicylate injections; in fact, my general impression was that it was less so. As regards the permanence of its effects, nothing can be said, of course, at the present writing, nor as to possible deleterious action, though the relation of the drug to atoxyl would warn us to be on the lookout for possible optic nerve trouble.

General Scheme of the Constitutional Treatment.—An affection whose treatment necessarily extends over a long period must be handled on some general plan. The ideal one, of course, would be to administer, at the very onset of the disease, a sufficient quantity of some parasiticide agent that would entirely destroy the spirocheta. We possess such agents, but unfortunately they destroy the body cells as well as the spirocheta. Future experience only can decide whether the dioxidiamidoarsenobenzol of Ehrlich can be used for the purpose.

A reliable abortive treatment being still only a hope for the future, two main plans of action are open to us. We can either regard each onset of symptoms as a recrudescence or relapse of the malady, treat it, and look upon the intervals of apparent health as periods when the body forces may be left to themselves, or we can regard the disease as a continuous infection, and keep up the appropriate treatment for the length of time that experience has shown to be necessary. The first plan may be called the *opportunistic method*; it is largely followed in Germany, but has never found much favor on the rest of the Continent or in this country. It has the advantages of minimizing the amount of mercurial treatment and of placing the patient in the best condition to be influenced by it when occasion requires. But it leaves out of account the undoubted facts that the infection must still be present even when there are no ascertainable symptoms; that no advantage is taken of the indubitable action of treatment in preventing the advent of syphilitic phenomena; and experience

has shown conclusively that it is not the best way of handling the disease.

On the other hand, there are distinct objections to an uncompromising continuous treatment during the long course of the disease. The remedies employed are necessarily poisonous; the system suffers from their use for too long a time or in too large doses; and we not infrequently see patients supposed to be suffering from intractable luetic disease who are really suffering from mercurial poisoning of insidious character. Besides this, tolerance to the drug is established in time; and our most powerful therapeutic weapons may be found to have lost their edge at the very moment when we need them most. The plan of treatment that I advocate combines the advantage of both the above while largely avoiding their dangers, and is known as—

The Continuous Intermittent Plan.—Here the mercury and iodine are given in accordance with a definite plan, which serves as a basis of treatment. It must never be forgotten, however, that it is a basis only, as intercurrent phenomena lead to its modification in almost every case. The drugs are to be given in definite periods and doses, with intervals between; and this no matter what the mode of exhibition may be, mouth administration, inunction, or soluble or insoluble injections. I shall detail the plan I follow myself with the insoluble injections that I usually employ.

Treatment is to be begun as soon as the diagnosis is made; that is to say, as soon as any two symptoms, including spirocheta findings or a positive serum test render it indubitable; and it is to be continued for three and if possible for four years.

First Year.—During this year, treatment should be most energetic and long continued, since the invading microorganism is at the height of its vigor and activity. At least twenty injections at intervals of from five to ten days should be given, the dosage to be at least 5 drops of the 20 per cent. mercury salicylate suspension. Both the intervals and the dosage will depend on the gravity and obstinacy of the patient's symptoms, ordinary cases receiving perhaps 8 drops every ten days, while those with severe or recalcitrant phenomena may require 10 drop doses every five days. I always make it a point to give a small initial dose, say 3 or 4 drops, to test the patient's susceptibility to the drug.

This first prolonged course will last then about six months, and then, if the patient's condition is good and active symptoms are absent, four to eight weeks are allowed to elapse without specific medication. During this time, however, the patient should be kept under observation; every two weeks or so he should be carefully examined, so as to detect and treat at once any symptoms that may arise.

The second course of the first year need usually not be either as prolonged or as heavy as the first. Eight to twelve injections usually suffice, dosage and timing being regulated as in the first course by the patient's symptoms and general condition.

The Second Year.—Here, as a rule, the intervals between injections may be longer, the doses smaller, and the courses shorter. Two ten to

fifteen injection courses with fortnightly intervals and more prolonged intervals between usually suffice.

The Third and Fourth Years.—In the absence of any special indications I give two moderate courses during the two years.

Subsequent Years.—The day will be a happy one for mankind when it will be possible to say that a case of syphilis is absolutely cured in the sense that there is no possibility of either the patient or his descendants suffering any further from his infection. Syphilitics recover, as I have stated before, in the great majority of cases; but exceptions occur, and none can tell in which class a given case may come. Neither the older mercurial nor the more recent arsenical preparations can guarantee a permanent cure beyond peradventure; and while it is manifestly our duty to emphasize the goodness of the general prognosis, it is of advantage, with intelligent patients, to state the facts explicitly and to endeavor to get them to take the further preventive treatment that is now widely advocated. I recommend in every case that for as many years as possible a short mercurial course be taken once a year. Half a dozen injections, with a moderate iodine medication, cannot possibly do any damage, and may possibly prevent the advent of postsyphilitic or parasyphilitic symptoms. Of course, it is only a minority of our patients who have the good sense and the persistence to accept this advice; but those who do should have the advantage of it. A similar course is to be recommended when any person who has once had syphilis is about to marry.

LOCAL TREATMENT OF THE SYPHILITIC PHENOMENA.

The general principles of local surgical treatment apply to lesions of the skin, mucosæ, and accessible organs when occasioned by syphilis; but in addition to this there can be no doubt at all that they can be directly benefited by the local employment of the specific medication. Secondary pus infection is the determining cause of some of the most serious and obstinate local and general phenomena of the disease, and a neglect of the measures required to obviate and remedy it is probably a more frequent cause of failure in our attempts at therapeutics than any other. On the other hand the beneficial effects of local mercurial medication is a matter of every-day observation. A striking example of it has been recently reported and pictured by Dohi. A Japanese whose trunk was covered with the elaborate tattooing in vogue there contracted syphilis and had a general papular eruption. A large figure of a mythological deity encircled his body, and the rest of the surface was covered with stars, flowers, and other devices. On the untattooed portions of the skin, and on the blue tattooed skin, the hair, eyebrows, and eyes of the god, as well as on the other blue devices, the eruption was abundant and marked; here the material implanted in the tissues was carbon (Indian ink). But the face and trunk of the figure, together with many of the flowers scattered through the rest of the design, were tattooed red with cinnabar, and here not a solitary papule was visible. Microscopic and chemical examinations

revealed the presence of metallic mercury in the red tattooed areas, though the operation had been performed a number of years before; and this deposited mercury was sufficient to entirely prevent the appearance of the lesions of the otherwise general eruption.

The local measures of general surgical applicability need no detailed description here, and the specific local medication will be best dealt with under the headings of the local treatment of the various lesions. It consists essentially of the employment of mercury, either the insoluble form in the shape of powders, ointments, etc., or the soluble ones dissolved in water, alcohol, ether, oil, etc.

Local Treatment of the Chancre.—In the uncomplicated form, if excision is out of the question, cleanliness and the avoidance of irritation is usually all that is required. If there is ulceration, a 10 per cent. calomel ointment and careful dressing is needed; later on a powder of similar composition or any of the ordinary surgical powder dressing is indicated. If the lesion is subpreputial, great care must be taken to completely expose the glans and sulcus and cleanse them at each dressing. For the complicated and unusual forms of the lesion the following is to be recommended:

1. *The Inflamed Chancre.*—Rest and wet dressings of hydrogen peroxide and water, 1 to 5, or of boric acid will always suffice.

2. *The Gangrenous Chancre.*—Rest, hot wet applications of boric acid or sublimate, 1 to 3000; or peroxide of hydrogen locally, either pure or diluted in accordance with the irritation it occasions, are our main reliance.

3. *The Phagedenic Chancre.*—Great care and attention is required to limit the destructive action in this mixed infection. Immersion of the organ for extended periods in water as hot as can be borne is an excellent general local treatment; and iodoform, xeroform, aristol, etc., will occasionally render good service. In bad and rapidly advancing cases, however, destruction of the margins with the actual cautery, nitric acid, or the acid nitrate of mercury may be required, followed by a wet dressing of peroxide of hydrogen, 1 to 5 or 10 of water. The application of dry heat has rendered me good service in several of these cases. It is most conveniently applied by means of the Paquelin cautery, the broad point of which, heated to a dull cherry red, is held for several seconds as close to the lesion as the patient can bear.

4. *The Chancre with Phimosis.*—Here there is always more or less balanoposthitis; if the phimosis is incomplete, so that the prepuce can be retracted, careful cleansing and the use of a mild boric acid ointment or powder (1 to 10) will suffice, the chancre being treated as in the uncomplicated cases. If the phimosis is complete, an attempt may be made to treat the intrapreputial condition by means of frequent injections of a warm potassium permanganate solution (1 to 1000) or other similar antiseptic and cleansing solution. In most cases, however, it is advisable to interfere energetically, since extensive ulceration is apt to go on in the closed sac. Sometimes a dorsal slit of the prepuce will suffice, in which case an attempt may be made to secure union of the edges of the

flaps with fine sutures. Usually, however, circumcision is indicated. The incisions both in this case and in that of the dorsal incision generally become infected; even if, with great care at the time of operation, primary union is apparently obtained, the scar subsequently hardens and takes on the characteristic chancrous appearance. The ultimate result, however, of both procedures is good. From a cosmetic point of view the complete operation is preferable, since the dorsal slit leaves two long tabs of skin and mucosa that are sometimes annoying in the future. It is needless to insist, of course, on the utmost care on the part of the operator to avoid an accidental infection himself in doing the work.

5. *Chancre with Paraphimosis*.—Hot-water applications, with the local use of cocaine and adrenalin, usually enable us to reduce the paraphimosis. If it does not, the knife must be promptly employed to cut the constricting band and permit reduction.

6. *The Lymphadenitis*.—This is usually non-inflammatory and requires no special treatment. An acute inflammatory adenitis generally means a mixed infection, either chancroidal or with pus organisms in addition to the luetic one. Rest, wet dressings, and belladonna ointment can be tried. If suppuration supervenes, incision and further treatment, as for a chancroidal bubo, is indicated.

7. *The Urethral Chancre*.—Intra-urethral initial lesions usually give little trouble and require no special treatment; abundant water drinking and alkaline diuretics will render the urine less irritating. Chancre of the meatus is very liable to cause more or less stenosis of the orifice later on, and it is well to keep a pledget of cotton soaked in vaseline in the orifice during the intervals between micturitions. The meatal stricture, if it occurs, may be subsequently dilated or divided.

8. *The Rectal Chancre*.—Hot lavage, suppositories containing cocaine with antiseptics, such as aristol, iodoform, etc., will mitigate the trouble these lesions occasion. Stricture is quite liable to be an after-result, and must be treated on general principles.

9. *Chancre of the Uterine Neck*.—Only in exceptional cases is attention to this lesion called by the patient on account of pain on intercourse, discharge, etc. It is undoubtedly one of the chief locations of infections of unascertained site of origin in women. Antiseptic vaginal douches, vaginal tampons impregnated with calomel, iodoform, or xeroform ointments are indicated.

10. *Cutaneous Chancre*.—A wet dressing of 1 to 2000 corrosive sublimate, mercurial ointment, or a 10 per cent. calomel ointment are appropriate local methods of treatment.

11. *Chancre of the Lips and Mouth*.—On the lips mercurial plaster or the white precipitate ointment gives good results. In the buccal cavity careful cleanliness, with a mercurial gargle, ordinary black wash, or a weak sublimate solution is indicated. Of course, the use of tobacco, alcohol, and all irritating food must be avoided; antiseptic gargles, permanganate of potash, peroxide of hydrogen, etc., must be frequently used.

Local Treatment of the Secondary Cutaneous and Mucosal Symptoms.—1. *The Macular and Papular General Syphiloderms.*—The ordinary forms of these eruptions require no special treatment, save on the face and hands, where their presence is annoying and suspicious. The use of a good mercurial soap, that is, one that really contains a soluble mercurial, in the place of the ordinary one, will suffice in mild cases. In severer ones a 5 to 10 per cent. calomel ointment, or the white precipitate ointment with mercurial ointment added in the proportion of 1 to 3 or 5, may be used at night or continuously. Women can use, in the place of the ordinary face powder, a starch powder containing 5 per cent. of calomel.

2. *The Pustular and Ulcerative General Syphiloderms.*—Here a more vigorous local treatment is in order. Mercurial plaster or ointment, the 10 per cent. calomel salve, the ammoniated mercury ointment, or the oleate of mercury, 10 to 20 per cent. in olive oil, should be used continuously, if possible. Sublimate wet dressing, 1 to 1000, may be employed for the worst lesions, which are usually on the lower extremities.

3. *The Macular, Papular, Erosive, and Ulcerative Secondary Syphilides of the Mucosa and the Mucocutaneous Junctions.*—The careful local treatment of these lesions is of great importance, for they are not only a source of discomfort and pain to the patient, but are extremely dangerous to his surroundings. In the mouth both the common specific angina and mucous patches require, in the first place, the entire avoidance of irritation, as by bad teeth, tobacco, liquors, and spicy or peppery foods. The buccal cavity should be put in as good a condition as possible by a dentist. One per cent. chlorate of potash, 1 to 4 hydrogen peroxide or 1 to 500 permanganate of potash, are good formulæ for gargles in the ordinary angina. Mucous patches can be swabbed daily for a time with tincture of iodine, or 10 per cent. silver nitrate solutions; if the solid lunar caustic is used the piece employed should be thrown away after each application. The more resistant plaques must be treated with active caustics, chromic acid, the acid nitrate of mercury, or nitric acid. It is needless to say that these agents must be used in the buccal cavity with extreme care. Not only may an amount of destruction far greater than is desired be readily occasioned, but the proximity of the glottis and larynx render special caution necessary. They should be applied by means of a small rounded wooden applicator, which should have no excess of liquid on it, and which permits of accurate and superficial cauterization. They should be done only every three or four days, and between times, and as a general gargle for these cases nothing has given me better results than the ordinary black wash.

On the genitals and the perigenital regions mucous patches and moist and exuberant papules are common and dangerous; and here also the avoidance of irritation, perfect cleanliness, cure of any discharge, and treatment of any inflammatory condition that may be present is necessary. I do not like the ointment applications in these cases, as they are very uncomfortable things to use and very readily decompose. Powders, like calomel, pure or with a varying proportion of starch, are far preferable.

Mucous patches must be cauterized as in the mouth, and exuberant papules must be treated with the nitrate of silver, chromic acid, etc., in the same way. In the female, in addition, the use of a mild bichloride douche, 1 to 10,000, is advisable.

Local Treatment of the Tertiary Cutaneous and Mucosal Symptoms.

—*The Papular, Tuberculous, and Gummatous Tertiary Lesions.*—The local treatment of these lesions has two objects in view—the prevention of ulceration and the avoidance of additional pus infection. Hence the rule is to protect them carefully from injury, under no circumstances to do anything that tends to cause ulceration, and to endeavor to get absorption with unbroken integument or mucosa. No matter how large the gummatous mass, and how soft and fluctuating its contents, it may still undergo absorption without breaking, and to the lasting benefit of the patient. This is especially the case with gummata of the nose and soft palate, in which I have frequently seen fluid masses apparently about to break undergo absorption without it under appropriate treatment; while, on the other hand, instances have not been wanting in which the premature incision of the soft mass, under the supposition that the lesion was a chronic suppuration, has led to perforation with all its ill results. The only cases of ulcerated cutaneous or mucosal tertiary lesions that I have encountered that were entirely recalcitrant to treatment have been such in which the added pus infection has occasioned general sepsis.

The non-ulcerated tertiary tuberculous or gummatous lesion must therefore be protected and treated gently. Dressing with mercurial plaster or ointment and careful bandaging must be the rule. When an important organ or area is threatened recourse may be had cautiously to local injections in the neighborhood of the lesion of a few drops of a 1 to 1000 bichloride solution; this has done me good service in a few cases.

The ulcerated tertiary lesions must be treated more vigorously. Crusts must be removed by softening with olive oil or vaseline, and regular cleansing with a mild peroxide solution undertaken. The application to be employed depends on the site and extent of the lesion, the amount of inflammatory reaction, the presence of pus infection, etc. In mild uncomplicated lesions the ammoniated mercury ointment, or the oleate of mercury in 5 to 10 per cent. solution in olive oil, is appropriate. More active lesions require a bichloride wet dressing, or mercurial ointment, either pure or mixed in the proportion of 1 to 3 of the ammoniated mercury ointment. When suppuration is marked, aristol, iodoform, or xeroform, either in powder or in ointment form, may be used.

On the mucous membranes the tertiary moist papules, mucous patches, and ulcerations must be treated similarly to those appearing in the secondary stage of the disease. Lesions of the tongue, buccal cavity, nose, etc., must be kept carefully cleansed with boric acid or peroxide of hydrogen solutions, and treated with applications of bichloride solutions, 1 to 1000, nitrate of silver, chromic acid, etc. The usual precautions as to the avoidance of irritation by tobacco, alcohol, food, etc., must be observed; and when the mouth is badly affected, so as to interfere with

eating, painting the affected surfaces with a 1 or 2 per cent. cocaine or eucaine solution before taking food may enable nutrition to be carried on more readily. Lesions around the genitals should be treated with calomel powder or ointment, 10 per cent.; while if the vaginal or urethral mucosa is affected, bichloride or black wash lavages will give relief.

Treatment of Certain Special Secondary and Tertiary Syphilitic Phenomena.—Under this heading I shall discuss briefly a few of the commoner happenings in the course of the luetic infection that have not been considered in previous sections.

Onychia and Perionychia.—Affections of the nails occur in early as in late syphilis in two forms—as an eruption of the dry papules or tubercles characteristic of the disease in the nail bed or around it, and as a chronic ulcerative process affecting the margin of the nail and the surrounding phalangeal tissues. The subungual papules had better be let alone; local treatment is not very hopeful unless needlessly severe measures to soften and remove much of the nail and thus permit the entrance of the medication into the affected tissues is undertaken. Entire avulsion of the nail for this purpose may in exceptional cases be necessary. Where the affection is periungual, however, mercurial dressings in the form of the calomel ointment, mercurial salves, or plaster are useful. In the ulcerated cases secondary infection plays a great part, and antiseptic wet or dry dressings must be used. The bichloride is probably the best for this purpose, since it fills the specific local therapeutic indications as well. But the citrine or other mercurial ointments are also effective.

Alopecia.—The patient frequently demands special treatment for this deformity, which in bad cases is such a manifest evidence of his infection; in the general alopecia that marks the early stage of the disease the prognosis is invariably good; the hair comes in again as it does after typhoid or other fevers. Nevertheless, treatment will help the newgrowth, more especially by removing from the follicles the dead and detached hairs that only impede the newgrowth. It is necessary to explain this to the patients and to inform them that they will lose more hair than ever during the first week or two of the special treatment. In addition to vigorous shampooing twice a week with green soap, the patient should use once or twice a day a sublimate-alcohol lotion containing a little glycerin. The following is the formula that I usually employ:

R—Hydrarg. chlor. corros.	gr. j
Glycerini	ʒss
Aquæ cologniensis,	
Aquæ destill.	āā ʒiij

Iritis.—This is a common and a serious complication of early syphilis, and requires vigorous local as well as the general treatment. Adhesions of the iris and permanent damage to the eyesight are liable to occur. A 2 per cent. atropine solution must be instilled into the eye several times a day, or even every two hours, until the pupil is fully dilated. If this is difficult to accomplish, or if adhesion has already begun, a fly blister on the temple of the affected side, to be kept open with a mezereon or

other irritant ointment until dilatation is effected, should be applied. The conjunctivitis is to be treated on general principles.

Palmar and Plantar Syphiloderms.—These may be extremely obstinate lesions in any stage of the disease, and require special treatment. The obstacle to local treatment is the hardness and thickness of the epidermic covering in these locations, and an attempt must be made to soften and thin it so as to permit the effective use of local mercurial treatment. Prolonged hot baths, scrubbing with green soap, or even the use of the pure green soap as a local application, and in the worst cases the use of the official caustic potash solution, diluted with two or three parts of water, will serve to effect the change. When, as is often the case, there is more or less eczema combined with the luetic phenomena, so that painful fissures and excoriations are present, the above measures cannot be employed; local mercurial vapor baths, calomel ointment, or the oleate, must be relied on. A good application is the following :

R—Hydrarg. oleat (20 per cent. solution)	3j
Ol. caryophylli	gtt. v
Petrolati	3 iij—M.
Sig.—External use.	

Nephritis.—This is of importance from two points of view: In the first place as to the treatment of nephritics who acquire syphilis, and in the second place on account of the comparative frequency of renal irritation during its course. In every case of the disease it would be well if regular analyses of the urine were undertaken, and mercury must be given cautiously, and in small doses, in patients whose kidneys are already damaged. The reason for this is the well-recognized fact that most of the mercury administered is eliminated through the urine, and the irritation of an already damaged organ may have very deleterious effects. A simple albuminuria occurs in the early secondary stage of the affection, and in the later ones a true nephritis. In all such cases an appropriate milk or milk-vegetable diet must be instituted, together with the special means usually employed in the affection. I prefer in these cases to give a mild mercurial by the mouth, such as the tannate in half-grain doses; injections are to be used cautiously, and in small amounts.

THE TREATMENT OF SYPHILIS IN PREGNANCY.

Mercury, formerly supposed to be dangerous in this condition, is now recognized to be our greatest safeguard against most distressing occurrences, and its administration as giving the best chance for both mother and child. Heredosyphilis with all its phenomena, from the earliest abortion on the mother's part to the latest appearance of the disease in the child's after life, can usually be controlled by the judicious employment of the medication. So entirely innocuous do I regard it that I do not hesitate to recommend and employ it in every case in which infection of either parent is even suspected, and that no matter how long previously

it is supposed to have occurred. Not only that, but in every known case of syphilis I give a mercurial course to the male during the first year of marriage. Of course, in the pregnant female there are many reasons for caution and for careful observation during the period of medication. Pregnancy itself entails an additional stress upon the various emunctory organs, and especially upon the kidneys, and it is a recognized fact that many women suffer from a distinct toxemia due to their condition.

As to the method of administration, I only exceptionally use the intramuscular injections in these cases. When there have been unmistakable evidences of infection, especially when there have been previous miscarriages, stillbirths, or infected infants, and when the woman is in good condition, especially as regards her kidneys, I employ it; but in most cases internal medication is easier and is effective. In the frequent cases in which the nature of the medication has to be concealed from the patient, either on account of secrecy on the husband's part or for psychic reasons, internal administration under the guise of other medication is a necessity. It is advisable to give some iodide if the infection is an old one, and the so-called mixed treatment formula given under the heading of internal treatment is as good as any that can be used. In the earlier infections I prefer the tannate of mercury, as being perhaps least liable to disagree. Treatment should be continued during the entire period of pregnancy and lactation.

THE TREATMENT OF HEREDOSYPHILIS.

Embryonal and fetal syphilis, which must be treated through the parent, has practically been considered above; there remain the consideration of the treatment of the infant born syphilitic, or manifesting symptoms soon after birth, early heredosyphilis; that of the child showing symptoms some years later; and lastly, that of certain malformations or dystrophies, general or partial, that are caused by the disease. In general, it may be said that both the symptoms and the treatment of heredosyphilis are similar to that of the acquired form of the disease, modified by the patient's age, the delicacy of the tissues, etc.

1. **Hygiene of the Heredosyphilitic Child.**—Breast-feeding offers the infected child by far the best chance of survival, and is always to be preferred when available. The mother, in accordance with the Colles-Baumé's law, is either already infected or immune, and should nurse the child whenever or as much as possible. Theoretically, an infected wet nurse would be the next best source of alimentation; but apart from the difficulty of obtaining one, her milk would probably not be good in quality. Artificial feeding will therefore be required when the mother's milk, for any reason, cannot be used. The infant should be kept under careful observation, the feeding well regulated, and all the functions attended to. Scrupulous cleanliness of the body, and especially of the mouth and the genitals, will help to prevent the appearance and promote the cure, when present, of the obstinate and dangerous lesions that are prone to happen at these points.

2. Mercurial Treatment.—This may be effected through the mother in mild cases, some proportion of the medicament passing into the infant's system through the milk. This, however, is usually not sufficient, and certainly not when active symptoms are present.

Under the heading of mercurial baths I expressed my preference for that form of treatment in infected infants. Inunctions into the soles of the feet, using 15 to 30 grains of mercurial or Neapolitan ointment daily for some twenty days, is effective; very often it suffices to place a piece of gauze spread with one of these or with the ammoniated mercury ointment under the belly band, and renewing it daily. The infantile skin is very delicate and absorptive, and the objections to the inunction treatment are less cogent with them than with adults. Older children can be given calomel in $\frac{1}{10}$ to $\frac{1}{4}$ grain doses three times daily, or mercury with chalk in somewhat larger amounts.

I have never regarded the injection of either the soluble or the insoluble mercurials as very suitable for children, on account of the small amount and delicacy of their muscular tissue, as well as the repugnance of both child and mother to them. Nevertheless, I have used them in exceptionally severe cases, diminished in amount, of course, in accordance with the child's age and weight.

Iodine is frequently indicated in heredosyphilis, the lesions of which, even in early and acute cases, are very prone to be of the late form (tuberculous and gummatous). On account of the delicacy of the respiratory mucosa in early life the dosage must be quite small, 2 to 5 grains of potassium iodide at a time being quite sufficient under ordinary circumstances.

The local treatment of the lesions of heredosyphilis is to be conducted on exactly the same lines as for lesions of the acquired disease, due regard being had for the exceptional delicacy and receptivity of the infant's skin and mucous membranes. The calomel and other similar ointments should be used in strengths of 1 to 3 per cent., the powders largely mitigated with starch, etc.

3. Treatment of the Late Lesions, Dystrophies, and Malformations.—Here the virus, if still present at all, is much attenuated; and so far as its direct management is concerned, mixed treatment in small doses and continued for long periods, is indicated. It should be kept up, with intervals, for two or three years; and it is well, as in the case of the acquired disease, to give a yearly short course for as many years as possible, to protect the patient as far as possible from further accidents. The permanent tissue changes and malformations are to be treated on ordinary surgical principles.

AUXILIARY MEDICATION.

Under this heading I include certain modes of treatment that have great value in certain cases, but which can in no sense be considered specific medications for the disease.

1. **Toxic, Non-mercurial Treatment.**—Iron, arsenic, quinine, the bitter tonics, a careful and nourishing diet, change of air, baths and hydrotherapeutic measures, horseback-riding and exercise, etc., are sometimes measures that have an astonishing effect upon debilitated syphilitics and such as are the subject of malignant manifestations of the disease. As a matter of fact, useful as the specific medication is in most cases, there occur instances in which the patient is suffering from overmedication, from confinement, from want of hygienic care, even more than from the infection *per se*. Some cases are distinct instances of chronic hydrargyrisms, though the classical evidences of mercurial intoxication may be absent. Mercury is a poison, as any substance that will inhibit or destroy spirocheta growth must almost necessarily be, and its too long-continued or too great use may cause deep-seated physical and psychical disturbances. Cases are occasionally seen that are said to be recalcitrant to mercury; their symptoms do not improve under any form of specific medication. They have often been overmercurialized; in the endeavor to improve their condition the drug has been given in large doses and without intermission for long periods. This is undoubtedly a mistake, and is not in accordance with the continuous intermittent treatment that is desirable. Now take such patients off specific medication entirely, put them under favorable hygienic conditions, attend carefully to their nutrition, and give them tonics, and it is the common experience to see such patients do well with only the local aid of cleanliness and ordinary surgical dressings. They also do well under any non-mercurial treatment, especially if it is new, and they furnish the main contingent for the marvellous reports that unfortunately so invariably mark their advent. This is a matter of great importance, and I cannot be too emphatic in the warning that patients may have too much specific treatment, and may be suffering from its effects.

2. **The Bath Treatment.**—No question is more frequently asked by the syphilitic of his medical attendant than one as to the advisability of his resorting to one or other of the medicinal springs here or abroad that have a popular reputation as cures for the disease. The whole subject of the efficacy of the mineral spring treatment is too large a one to be entered upon here; and there can be no question that arsenical and chalybeate waters, taken internally, may be of benefit as an adjuvant to treatment in some cases. I have seen no reason to believe, however, that the external use of sulphur baths, mud baths, etc., are of any special efficacy; and, as a matter of fact, the practitioners in these resorts always employ the ordinary medicinal treatment also, though they may attribute the results to the baths. The regular life, the careful feeding, the attention paid to hygiene, and especially the change, are of benefit; but all of these can be obtained elsewhere. One important advantage they have is that they enable the patient to get away from his friends and surroundings during the periods that tell-tale evidences of his infection may be present. But the disadvantages, trouble, and expense incurred may well counterbalance these advantages. I do not believe that there is any therapeutic value in the baths themselves.

3. Serotherapy, Opoththerapy, and Vaccination.—For the sake of completeness, brief mention of these treatment methods may be made. The attempts of Metchnikoff and Roux to obtain a serum of antivirulent properties from anthropoid apes have had some laboratory success; but those of Cippolina and Russo to employ animal vaccine material on the human subject have not given any definite results. Neisser and Baermann, Finger and Landsteiner, and others have tried opoththerapy, attempting to modify the course of an infection by the injection of emulsions and preparations of various syphilitic products. Their results have been practically negative. The endeavors to get a vaccine for the disease by modifying the virus by physical, chemical, or biological means, or by passing it through the animal organism, have failed; and Neisser concludes that every virus produces a typical syphilis, save when the virus is dead or introduction of it into the system has not succeeded; no such thing as an attenuated or purely local syphilis has resulted.

THE DYSENTERIES

By THOMAS LEIDY RHOADS, M.D.

THE dysenteries include a group of specifically distinct diseases, differing in etiology and in pathological features, and hence require a diversity in clinical management. The treatment of the different types of dysentery is based partly on known etiological factors and on a clinical observation of the value of the various drugs and agents that have been employed in dealing with these different types, and the selection of those means found to be of greatest value.

In outlining the treatment, only those types of dysentery most commonly met with, and recognized as distinctive, proof of which has been fairly well established, will be considered. It is not to be doubted that there are other varieties of dysentery of like causation, and with clinical manifestations in many ways similar to those types here briefly discussed, but they are as yet unrecognized as specifically distinct diseases, and, therefore, offer no guide as to the treatment to be followed even in a measurably rational way, as may be done in most cases of the known types of the disease.

The following classification includes those types recognized as distinctive:

1. Dysenteries caused by protozoa:

- (1) ENTAMÆBIC DYSENTERY: { *Entamæba histolytica*.
Entamæba tetragena.
- (2) MONADIC DYSENTERY: { *Trichomonas hominis*.
Lambliia intestinalis.
- (3) BALANTIDIC DYSENTERY: *Balantidium coli*.
- (4) LEISHMANIC DYSENTERY: *Leishmania donovani*.
- (5) PLASMODIC DYSENTERY: { *Plasmodium vivax*.
Plasmodium malariae.
Plasmodium falciparum.
Plasmodium falciparum
quotidianum.

2. Dysenteries caused by metazoa:

- (1) HELMINTHIC DYSENTERY: { *Schistosomum mansoni*.
Schistosomum japonicum.
Fasciolopsis buski.

3. Dysenteries caused by bacteria:

- (1) BACILLIC DYSENTERY: { *Shiga bacillus dysenteriae*.
Flexner bacillus dysenteriae.
Subsidiary strains.

These several types have prominent features more or less in common, and such clinical characteristics will be borne in mind in discussing treatment, for they present an impressive array of signs, symptoms, and tendencies which will call forth the best efforts and judgment of the physician,—such as the intestinal ulceration, the abdominal pain and tenesmus, the frequent small, slimy stools mixed with blood, the proneness to hemorrhage and collapse, the tendency to chronicity, and the liability to sequelæ of weighty significance.

ENTAMŒBIC DYSENTERY¹

Entamœbic dysentery is found in epidemic or sporadic form throughout the tropics and in most countries in the temperate zone. In those countries having distinct wet and dry seasons it is generally more prevalent toward the end of the dry season, when dust-storms are frequent and flies abound, and at the beginning of the rains, when drinking-water is more likely to be polluted and vegetables are contaminated by surface washings. The disease may occur all the year round in both zones.

The disease is brought about by the ingestion or inhalation of the entamœba spores, which produce the young entamœba on arrival in the large bowel. The activity of the young entamœba in the wall of the bowel marks the beginning of a series of morbid changes in the gut, which are associated with a corresponding difference in clinical manifestations as the disease advances; and as the earlier lesions and symptoms of the acute stage differ materially from the pathologic changes

¹ *Entamœba histolytica*, Schaudinn, 1903, a cause of entamœbic dysentery, fully grown, measures 25 to 35 microns in diameter. It shows a characteristic greenish coloration, has a clearly defined ectoplasm, and numerous vacuoles present in the endoplasm. The nucleus is small in size, poor in chromatin and situated away from the centre of the organism, sometimes near the periphery, and changes its shape and position when the organism is in motion. The parasite feeds on detritus and red corpuscles, and has long, finger-like pseudopodia which Schaudinn considers capable of burrowing into epithelial and connective-tissue cells, and which he believes afford a diagnostic clinical difference between this pathogenic genus and *Entamœba coli*. The organism is very actively motile. Reproduction occurs by fission, gemmation, and sporulation. In spore-formation the chromatin in and around the nucleus collects near the periphery, and the remainder of the nucleus disappears by absorption. The ectoplasm forms small knobs, containing several chromidia in each, and these become separated as rounded bodies, becoming surrounded by a yellowish-brown envelope, and form the spores for the infection of a new host; it is only by the spores that infection can be spread. The organism has not yet been cultivated.

Entamœba tetragena, Viereck, 1907, is likewise a cause of entamœbic dysentery in North and South America, Africa, and some of the islands of the Pacific. It has a distinct ectoplasm, enveloping a granular endoplasm. It is phagocytic for red corpuscles, and has a large round nucleus which is rich in chromatin. In sexual reproduction the nucleus divides into two nuclei which undergo zygosis, indicating that self-fertilization takes place. The zygote encysts and its nucleus divides, finally forming four nuclei. Its later history is not known.

Paramœba hominis, Craig, 1907, discovered in the feces of natives and American soldiers in the Philippines, produces chronic exacerbating diarrheic movements resembling those of chronic entamœbic dysentery, the stools showing blood and mucus. The parasite is peculiar in that it possesses both a flagellate and an amœbic stage in its life cycle, and is to be considered as a possible cause of this form of dysentery.

and manifestations of the disease in the chronic stage, treatment of the disease will be considered under these divisions.

Acute Stage.—The treatment of entamœbic dysentery in the acute stage is entirely medicinal, combined with careful nursing. Assured of a correct diagnosis, it should be recognized that we have a profoundly dangerous disease to deal with; that our object is to afford the acutely ulcerated bowel favorable conditions for repair; that anything that would tend to increase the irritation of the highly inflamed bowel must be withheld; and that our best efforts must be directed to the cure of the disease in this stage, so as to avoid chronicity. The supervention of sequels is more to be feared than the disease itself. For the accomplishment of these objects absolute repose of the patient is imperative, energetic treatment and careful nursing are requisite, and those drugs are indicated which are known to have cardinal value in the management of this disease.

As the lesions of the disease are of a severe local inflammatory nature, beginning with small, abscess-like formations in the mucosa, which rapidly break down to form the typical ulceration in the wall of the gut, with the consequent toxin absorption, the first important thing to bear in mind is that rest is an absolute essential—rest in bed for the body and rest for the bowel as well. This applies not only to those patients who are manifestly very ill from the onset, but to all cases of entamœbic infection, including those mild cases that appear for treatment with subdued symptoms, and whose only complaint may be a recent looseness of the bowels, but whose stools reveal an active entamœbiasis in progress. The lesions in all cases are the same, merely differing in degree, and all cases are equally liable to the direful results of chronicity if the disease is not cured early in its course.

The patient is to be put to bed and kept warm. Because of the pain and exhaustion from continued tenesmus, and the prostration arising from 15 to 20 evacuations and more a day, the body temperature will frequently drop below normal, and all risk of chill must be avoided. The patient's body should be protected constantly by suitable warm clothing, particularly the abdomen, and the least possible disturbance should be practised in carrying out the necessary nursing, the evacuations being voided, without rising, into a receptacle in bed. Under no circumstances should he leave the bed when he has a call to stool, for by so doing he would not only defeat the object of recumbency, which relieves the bloodvessels of the ulcerated bowel of a certain amount of hydrostatic pressure, but he would be liable to the influence of draughts. I frequently have seen cases with violent tenesmus, straining for many minutes on a stool by the bedside, too wretched to realize that they were adding to the gravity of their condition by resting their bare feet on damp floors. The commode must be replaced by the bed-pan and urinal in these cases.

In like manner, we must avoid adding to the distress of the patient and irritating the acutely inflamed bowel, by manipulations and strained postures in attempts at colonic irrigation and distension during the early

stages of the disease. High flushing enemata have their place later on in the treatment when the acuteness of the symptoms has begun to subside and healing has set in, but in the first days such treatment should be avoided.

At the onset it is a good plan to give a dose of castor oil, two to four tablespoonfuls (30 to 60 c.c.), to which is added ten drops (0.65 c.c.) of laudanum. I usually give this preliminary dose disguised in a little weak coffee. In mild cases this initial dose of oil will have such a beneficial influence on the disease that one is tempted to consider the case cured in the course of a day or two, and to abandon further treatment. Such a conclusion, however, would be a grave error. We have no means of telling positively the extent of the disease in the affected bowel or the exact stage of the process of repair, on account of the inaccessibility of the lesion. While the symptoms are usually proportioned to the extent and intensity of the ulceration, this is not necessarily the case, for an extensively diseased colon is frequently discovered at necropsy in the ambulatory type, the patient having suffered little discomfort. Cases of relapse months later, or of liver abscess resulting from what was considered a trifling entamœbic infection, not marked enough to demand careful treatment and confinement to bed, are observed so frequently as to be impressive. No case of dysentery should be considered trifling; and, even though the initial dose of oil apparently checks the disease, it is my plan in all cases of entamœbic infection to insist on a set course of treatment for at least two weeks, or until the daily microscopic examination of the feces has proved negative for parasites for one week before discharging the patient as cured.

Ipecacuanha and *quinine* are the sovereign remedies—the former by the mouth, the latter by rectum. This applies to those forms of entamœbic infection found in the United States and its dependencies, in most European countries, and in the East. *Ipecacuanha* is the drug which English physicians in India consider in the light of a specific, from whom, more particularly from Sir Patrick Manson, we have learned of its value in these cases. After experimenting with various other drugs in the treatment of this disease during the past decade, in this country and in the Philippine Islands, where succeeding epidemics of dysentery caused four times as many deaths among the soldiers of the army as any other single disease, and comparing the excellent results that are obtained now that a general use of *ipecacuanha* treatment is practised, I am satisfied that its efficacy is far greater than that of any other drug used in the early and acute stages of this disease. I also believe that the failures I experienced in treating the earlier cases with *ipecacuanha*, and which I at the time attributed to the inefficacy of the drug, were due either to delay, which permitted the entamœbæ to make inroads into tissues underlying the mucosa, or to the fact that the cases were due to bacillic infections, in which variety of dysentery the drug is of little use. If properly administered, the drug will give brilliant results in the majority of cases, acting not only as a specific to the

intestinal disease, but as a preventive of the hepatitis which so frequently eventuates in liver abscess.

The patient having received his preliminary purge, and all food and water having been proscribed for six hours, is given a hypodermatic injection of morphine sulphate, gr. $\frac{1}{4}$ (0.016 gm.), to prevent vomiting. At the same time an ice-bag filled with finely cracked ice and protected with two thicknesses of gauze is placed over the pit of the stomach and another over the anterior surface of the neck. The patient is directed to lie flat on his back, a third ice-bag being substituted for a pillow and placed under the nape of the neck. The patient is cautioned not to speak or move for four hours. A half-hour after the morphine injection, when its quieting influence will have occurred, the ipecacuanha is administered in eight to twelve pills of 5 grains (0.32 gm.) each, or in capsules of like amount, the leeway in dosage depending on the sthenic condition of the patient.

Ipecacuanha is frequently administered in pills coated with salol varnish, to provide for the passage of the bolus through the pylorus before the varnish is dissolved, by the action of the pancreatic juice. When the drug is given in this form, the nauseating effects are often avoided, and the precautions advised above need not be carried out. Practically, however, this mode of administration is not always reliable, as, in my experience, the varnished pills were frequently passed by the patient with the coating intact. If this occurs, valuable time is lost in the treatment. When given in plain pill or capsule form, the action of the drug may be depended upon.

The patient is encouraged to resist the desire to vomit by mental effort and to try to sleep. When the saliva begins to flow freely, as it usually does after the ipecacuanha administration, he should be cautioned not to swallow it, but to notify the attendant, by a slight pre-arranged sign, who will remove the accumulated saliva with a piece of gauze. Unless this is done vomiting will almost certainly occur. In most cases these precautions will ward off emesis; if, however, vomiting does occur within an hour after the ipecacuanha was administered, the dose should be repeated when the stomach has again become quieted, the same precautions being used to prevent further emesis.

After six hours, all feeling of nausea having subsided, a small glassful of iced ginger-ale or a cup of tea is given, and this is followed by frequent feedings of beef-tea and albumin-water late into the night. The following morning the dose of ipecacuanha is repeated with the same precautions, and again on succeeding days, until copious, pultaceous, brownish-yellow stools appear, and rapid amelioration of acute symptoms give evidence that the process of healing has set in. This being the case, the dosage of the ipecacuanha is reduced to a 5-grain (0.32 gm.) pill or capsule three times daily and continued for about a week longer; the diet is increased, and at the same time lavage of the colon is begun.

High irrigations by rectum are valuable for removing necrotic tissue overlying the intestinal ulcers and lining the connecting sinuses, and

if to the irrigating fluid be added a drug of known entamœbacidal virtue, the value of the irrigation is greatly augmented. The experience of many observers has shown that quinine is the best drug to use for this purpose, as it is a potent protoplasmic poison, and it appears to have a selective action for the protoplasm of entamœba. The use of this drug in irrigating solutions has given most satisfactory results in these cases, and there is no doubt that it will arrest the ulceration in the gut and promote healing when the drug is exhibited at the proper time in the course of the disease. It is a valuable adjuvant to ipecacuanha, and its conspicuous value in treatment is in the pathological stage when the primary lesions, and the abscess-like formations in the wall of the bowel, have broken down and have become ulcers, and before these ulcers have become chronic. In the first stages of the lesion the exhibition of the drug in copious enemata may do harm; in the chronic stage, it has no distinct value.

Theoretically, given a disease with lesions limited to the lining of the large intestine, a local approach to the seat of the disease by the nearest route and with medicaments of germicidal value would appear to be the ideal method of treatment. An exclusive reliance on colonic distention and flushing with fluids destructive to entamœba, however, has been disappointing in bringing about permanent cures. No drug has yet been found that will supplant in effectiveness the apparently specific action of ipecacuanha in the early stages of the disease, and the role of quinine by injection must be considered as merely supplementary to the ipecacuanha and of special value in treatment only at a time when the bowel will not suffer from irritation and distention. When ulcers need cleansing, and when entamœbæ are exposed in these ulcerations to the destructive influence of an agent that inhibits their growth and dislodges them, and before they have invested the deeper layers and are beyond the reach of local action, the use of quinine is most valuable.

A cleansing enema of warm water having been given to remove all fecal matter, and the whole of the injection having escaped, a No. 16 male soft-rubber catheter is passed for nearly its entire length into the bowel, the foot of the bed being raised $1\frac{1}{2}$ feet from the floor, and the buttocks elevated on a small, firm pillow. Bihydrochloride of quinine, in a solution of 1 in 1000, at a temperature of 100° F., is allowed to flow by gravity from a container three feet above the patient's buttocks, until the colon is well filled, or until the bowel rebels against further distention. The amount of solution to be injected cannot be definitely fixed, as the size and tolerance of different colons will vary; usually from 1 to 2 litres will suffice. The patient should be encouraged to retain the solution for fifteen minutes without changing his position, and depending on gravity for the fluid to find its way up the coil of the large gut. The bed is then lowered, the support is removed from beneath the buttocks, and the clyster is voided into the pan. The greatest possible care must be exercised in inserting the catheter into the diseased bowel, the tube being introduced gently and slowly, any undue pressure being avoided when resistance is met with; otherwise a perforation may result should

the tip of the catheter engage a point of ulceration that is deeply necrotic. The injections are continued daily until the patient is considered cured.

The special symptom which requires additional consideration during the early stages of the disease is the pain from griping and tenesmus. This is best relieved by an ice-bag over each flank, and ice suppositories, if the patient be sufficiently sthenic and will not suffer too much collapse from the continuous application of cold when a refrigerating plant was at hand. I have successfully used the ingenious method of Usher, of freezing distilled water in test-tubes, and inserting these molds carefully into the bowel when tenesmus was severe. Should the application of cold be contraindicated by collapse and low body temperature, hot-water bags may be substituted, or an electric heater, when such is available. Morphine may be administered hypodermatically in $\frac{1}{4}$ -grain (0.016 gm.) doses.

The diet in these cases is important, for we must guard against starving the patient, on the one hand, and, on the other, against prescribing a diet that will overtax the functioning capacity of the diseased bowel. Indigestible foods will be a source of irritation to the acutely inflamed area, and will add numerous colonies of putrefactive bacteria to the existing infection. No arbitrary list of food-stuffs can be set down that will be applicable to each patient and to each day of his disease, or to every location in which the disease occurs. However, there are certain set principles in feeding these cases which I consider essential to successful management; briefly stated, these are: during the early acute inflammatory stage, the restriction of food to a minimum amount, to consist entirely of proteins, carbohydrates, and water, selected so as to limit the putrefactive products in the intestinal canal, and so prepared as to leave the least amount of fecal residue—beef-tea, mutton broth, and sweetened albumin-water; the withholding of fresh milk as an article of diet during the entire course of the disease, as I have found that patients with dysentery do not absorb and assimilate milk well, and the undigested curds are a fruitful pabulum for germ growth; sour milk, however, has not these disadvantages, and is particularly beneficial in inhibiting the activity of the proteolytic organisms in the large bowel if made with lactic acid bacilli of the acidophilus type, and may be given freely after the first week, with clear soups and zwieback. The gradual transition from liquid food to soft diet by the addition of more carbohydrates, and of hydrocarbons to make the daily amount of food ingested equivalent to 1500 calories in twenty-four hours, is essential. After acute symptoms have subsided, and entamœbæ have been absent from the dejections for at least one week, a full diet may be given with the exhibition of a fruit acid in the form of lime-juice as a preventive of the fermentative indigestion which frequently supervenes in these cases, and which so often eventuates in a condition simulating sprue.

The treatment thus briefly outlined, I believe, will give the most satisfactory results in acute infections. However, the use of ipecacuanha has not always been attended with success. In certain localities, as in Egypt, the drug has been found disappointing, and good results

are obtained by recourse to the aperient sulphates from the outset. The sulphates of magnesium and sodium are selected,—the latter being the less irritating,—these salts having the advantage over ipecacuanha of not causing emesis, and, therefore, no steps need be taken to combat this troublesome complication. Either of the salts may be given, and administered in dram (4 gm.) doses in hot water, or in peppermint-water, or in combination with aromatic sulphuric acid, every twenty minutes until free gentle purgation is produced, when the intervals are lengthened to an hourly dosage. Frequent watery stools are the signal for discontinuance of the drug, and it must be used cautiously when the patient is feeble or has any tendency to collapse.

Simaruba is favored by many physicians in the East, and is used in place of ipecacuanha in the initial stages of the disease, given in large doses of a strong infusion of the bark, or used as a supplement to ipecacuanha in the final days of treatment. At such times it is usually combined with aromatics and an intestinal antiseptic such as salol, salicylate of bismuth, or benzo-naphthol. This drug's principal value lies in arresting acute exacerbations, but its curative properties do not compare with those of ipecacuanha.

Another drug regarded with high favor in the East, especially in Cochin China, where the plant is indigenous, is Kho-sam, which Lemoine regards as exercising a curative action by depriving the entamœba of blood which he regards as their chief article of food, the drug being hemostatic and astringent. The powdered drug is given in 1-grain (0.065 gm.) pills, three or four times daily.

In Germany the method of treatment by calomel is mostly in vogue, either in 5-grain (0.32 gm.) doses, three times in twenty-four hours, or in fractional doses every hour. This treatment is purely eliminative. Calomel is a direct irritant to the intestinal mucosa, its purgative effect depending on this action, and when purgation begins, it adds to the griping that already exists in the severe forms of this disease. As in many other intestinal affections, the use of mercurials is much abused, and, in the acute ulcerative process of the intestine which constitutes the principal pathological condition in entamœbic dysentery, the use of this drug is contraindicated.

I likewise look with disfavor on the administration of bismuth, heroic doses of which—3 drams (12 gm.) every three hours—are recommended by some physicians. The drug retards the intestinal movements, covers with an insoluble coat the necrotic sloughs overlying ulcers, prevents the discharge of these sloughs, and the entamœbæ with which they are impregnated inhibits the healing process in bridged-over sinuses, and favors the migration of entamœbæ to the deeper layers and into the terminal vessels. Altogether it masks the real condition of the patient, and gives one a false feeling of security in dealing with this malady. As I look back on patients thus treated, I attribute the development of a number of cases of liver abscess to an undue reliance on bismuth and misplaced zeal in checking dysenteric movements in the first days of the disease.

In colonic irrigation other drugs are frequently substituted for quinine, among these, nitrate of silver, formalin, carbolic acid, copper, and tannin having been used more or less widely. The chief objections to these drugs, exclusive of their theoretical disadvantages, as compared to the action of quinine on these parasites, are the excessive pain they produce, their irritant action, and the early toxic symptoms which are apt to follow their use. Irritant chemicals I am convinced have no place in the treatment, and a trial of these drugs has frequently resulted in the dysenteric symptoms becoming more manifest, and in some cases has been responsible for a lethal termination.

Fortunately, we have in ipecacuanha and quinine two drugs which, in the majority of cases, will bring about a cure. The patients will in the course of from two to six weeks be free from symptoms, will be able to resume a liberal diet without untoward effects, will pass stools normal in every particular, and the entamœbæ will have completely disappeared from the dejections. The remedies are, however, not infallible. A small percentage of cases will develop fulminating symptoms from the start, with sharp chills and the phenomena of blood-poisoning, which stamps them as practically hopeless, and the majority of these are lost. Others will resist the most painstaking treatment, and while they will be tided over the acute stage with some amelioration of symptoms, yet they remain quite ill; the stools continue to be passed frequently, they become very offensive from the presence of cast-off sloughs, and the disease advances to the chronic stage. The physician is now face to face with one of the hardest problems in medical practice.

Chronic Stage.—If treatment is now kept up as carried out in the acute stage, a very small number—a number too small to warrant its continuance—will eventually get well after weeks and months of changes between better and worse, until recovery slowly sets in. The tendency of the disease after it has resisted treatment thus far, and once it has reached the chronic stage, is not toward a cure. It tends then to assume one of three clinical forms; first, the patient becomes worn out by the persistence of symptoms, sinks rapidly, and dies early in the chronic stage; second, the urgent symptoms abate but do not completely disappear; the patient gains in weight, loses some of his ashy pallor, and his stools become partly formed, but he continues to have from two to six movements daily, attended with slight griping, and on examining the contents of the vessel the feces are found dotted with islands of blood-stained mucus, and floating free in the pan are seen opaque masses consisting of epithelium, mucus, and pus matted together in variable amount. Notwithstanding that he is apparently slowly gaining ground, suddenly and without manifest cause, active symptoms reappear. Several weeks elapse and the acute exacerbation subsides. He again enters on an apparent healing stage, when another relapse occurs; and so the malady continues until, after many months of bedridden invalidism, he finally succumbs in great misery; third, the patient progresses through his acute attack most favorably, but recovery is delayed, and treatment is relinquished before he is quite well and while enta-

mœbæ still persist in his stools. Later on he becomes subject to mild attacks of colic and diarrhœic movements at variable intervals, following fatigue or dietetic indiscretions or bibulous indulgence, these attacks being succeeded by days or weeks of marked constipation and the passage of scybalous masses and blood-streaked mucus, associated with pain over the left iliac fossa. His digestion becomes impaired from a gradually complicating gastritis or a gastro-enteritis, and emaciation and debility follow. By careful dieting and nursing he recovers some of his lost strength, but his bowel movements never become normal; diarrhœic stools continue to alternate with constipation; bloody mucus is discharged at intervals; he remains cachectic; and thus he passes the rest of his years, never in good health, and progressing slowly and steadily downhill.

How are we to anticipate these conditions, reducing, on the one hand, the heavy ravages of the disease after the acute stage, and preventing the long period of invalidism to which these patients fall heir after the disease has become chronic? At times a long sea-voyage and a change of climate will be of benefit, and with the building up of the general health the intestinal disease will undergo repair; in the majority of instances, however, the local lesions persist, even under such favorable conditions, and recurrences and relapses will demand renewed efforts to bring about a cure. It must be said that treatment, as it is usually carried out, does not attain results that are very satisfactory. The difficulty lies in reaching lesions that are too remote for irrigations to have any decided advantage, and in attacking parasites that have burrowed deeply into the intestinal wall. The most that is usually accomplished is a mitigation of urgent symptoms in severe cases, and a relief, seldom a cure, in the milder ones. Even in the most favorable cases so many supposed recoveries have been followed by disappointment, so many times improvement has been succeeded by relapse, that prognosis as to permanent benefit is generally looked upon as doubtful. Craig has said: "From my experience there is no disease so resistant to treatment and in which prognosis is so discouraging as entamœbic dysentery." This statement can readily be confirmed by a study of the many remaining cases in wards after a dysentery epidemic, and by keeping track of those cases which leave the hospital much improved or supposedly cured, but which are, as a rule, only partially relieved of the distressing malady.

Before taking up a decisive plan of treatment for the chronic stage, let us understand what changes take place within the gut. In the acute stage the lesion is primarily a small, nodular elevation containing a yellow, gelatinous fluid, and is confined to the superficial layers of the bowel. These nodules are formed by the cellular and edematous infiltration of the submucosa, induced by the entamœbæ which entered the mucosa between the cells lining Lieberkühn's follicles from the intestinal canal. The parasites having reached the submucosa live and feed upon tissue-cells and red cells, and elaborate a poisonous material which acts upon the mucous membrane, destroying it; the summits of the projecting nodules slough and are cast off, and small ulcers are formed which rapidly

deepen until they extend into the submucosa. These ulcers become infected with bacteria, and spread by the joint action of the entamoebæ and the bacteria, until the typical rounded ulcerated areas are formed with rough bases and undermined ragged edges. These areas are most commonly located in the cecum, sigmoid colon, and rectum, but may occur anywhere along the course of the large intestine, and form the developed lesion of the acute stage in the usual run of cases. In the more serious cases the lesions may extend rapidly and may cover the entire surface of the large bowel.

As the disease progresses to the chronic stage, the ulcers become larger and larger, and extend to the deeper layers of the gut, gradually invading the muscular coat of the intestine. This progressive necrotic process leads to the formation of sinuses connecting the ulcers, the sinuses being situated usually just beneath the mucosa, and invariably containing entamoebæ and bacteria in the necrotic material. If the ulcer increases in size by a slow process, the floor becomes more or less smooth and the edges rounded, but if the extension is rapidly progressive, the spreading edges continue ragged and the base is covered with necrotic material, pus, blood, and entamoebæ. In many of the ulcers an arrest in necrosis takes place when the muscular layer is reached, it seemingly offering a resistant barrier to a further extension of the disease; but in some instances as the ulcer deepens a necrotic slough of this coat is produced, which, when it is cast off, exposes the peritoneal coat, or results in a perforation which leads to peritonitis or abscess formation, according to the position of the perforation. In other instances the ulceration interferes with the circulation, or the entamoebæ invade the branches of the mesenteric arteries, and cause thrombosis; in either of these happenings gangrene of that part of the intestine will result.

In the slowly progressing older ulcerations, marked thickening of the intestinal wall may take place, and I have seen colons dissected out with walls over half an inch in thickness. The thickening may occur in limited areas, or it may involve the entire large bowel. Usually in these cases the greater part of the mucous surface is entirely destroyed by the extending ulceration. As the sloughing continues the vessels in the path of the ulcer become exposed and break down, the severity of the hemorrhage depending on the calibre and number of the vessels involved.

Some of the ulcers will heal and the base will be filled with scar tissue; others will become partially healed, with clean floors and edges, and if the ulcers are large, the healing process may go on in one segment and the other part will continue to extend. If complete healing takes place in large ulcers, the scar tissue may form a cicatrix which will constrict the lumen of the bowel, causing stenosis.

Viewing the pathological changes that take place in the bowel, it must be realized that when the ulceration has reached the degree of invasion that is associated with chronicity, the condition is no longer amenable to medication by mouth, and that irrigations by the rectum are but an uncertain way of attacking the deep-seated and extensive lesions that involve any or all portions of the large bowel. We now have

to deal with the effects of a destructive process, wherein are concerned not only entamœbæ, but the various bacteria of suppuration, and where tissue necrosis has largely outstripped the process of repair. The condition has resolved itself into one requiring surgical interference to aid nature in restoring the diseased bowel, and, if restoration is not possible, to relieve a depleted system of a diseased organ with which it is not able to cope. The plan of treatment I advocate is set forth in a consideration of the following surgical methods.

Appendicostomy and Cecostomy.—The method of utilizing the appendix for the introduction of fluids into the bowel in the treatment of dysentery was devised by Weir. Its use has been limited generally to cases of long standing that have proved intractable to the various medicaments administered by mouth and rectum. Appreciable improvement has followed where this plan of treatment has been instituted. The beneficial results are shown by the disappearance of toxic symptoms, the return of appetite, the gain in weight, the control of bowel movements, and the mending of the health generally. The advantages of this method of treatment over rectal irrigation are, that it insures a satisfactory flushing of the entire large bowel, particularly of the head of the colon, which is, to a considerable degree, inaccessible to fluids introduced through the anus; and it avoids the pain and dangers incident to the extreme colon distention necessary in attempts at reaching this distant point by the rectal route. The operation is simple in performance, and may be done under local anesthesia without risk to the patient.

The appendix is delivered through the ordinary incision, and is fixed to the skin by a suture through the mesoappendix, and by several more through the appendix wall. The tip of the appendix is removed, and a probe is passed into the bowel to assure a patulous lumen. Two points must be observed, as stated by Arthur: the colon must be left in its natural position, hence tension on the appendix is to be avoided, and the outer surface of the appendix should be lightly scraped to expedite adhesions to the abdominal wall. Irrigations may be begun at once. The largest soft-rubber catheter that will fill the lumen of the appendix is passed into the bowel, and the gut is flushed with the quinine solution, by means of the usual apparatus, once or twice a day. The catheter is left in place until the abdominal wound is healed, its free end being clamped and coiled up in the dressings; it is then withdrawn, and thereafter reinserted at irrigation time. The lumen of the appendix will increase from repeated manipulations with the catheter, and the size of the catheter must accordingly be increased to avoid leakage during irrigations. The patient after the first week is taught to irrigate himself if he is physically able; this is usually learned readily, and he is thus relieved of constant care by a nurse. During the first week a rectal tube may be a necessary accessory to insure a continuous flow, but as improvement takes place, this is dispensed with.

Under certain conditions cecostomy is substituted for appendicostomy. The conditions calling for it are: the appendix may have

been removed by a previous operation, or it cannot be readily found; it may be so involved in the dysenteric disease that we dare not utilize it; it may not be patulous, from stricture, or it may be of insufficient calibre to pass the smallest size catheter; the mesoappendix may be so shortened or twisted in a fixed position that pain would result from tension, the walls of the appendix being poorly supplied with elastic tissue. Under these circumstances the method of Gibson is made use of to effect flushing. This is an adaptation of the Kader method of valve formation in the wall of the cecum, and takes advantage of the normal position of the head of the colon in its relation with the anterior abdominal wall. The cecum is brought up and a valvular opening is made in one of the muscular bands, after placing two purse-string sutures which will engage a snugly fitting catheter pushed into the cecum and anchored to the edges of the opening. The purse-string sutures are drawn taut and tied, which puckers up the tissue around the catheter to make a bearing surface. The ends of these sutures are fastened to the abdominal wall to prevent the cecum dropping back, and irrigations are carried out as after appendicostomy. The only advantage the appendicostomy procedure has over cecostomy is that it secures a longer and firmer bearing surface for the irrigating tube and leakage is less likely to result, and it leaves the bowel in its normal position. Cecostomy, on the other hand, is not necessarily confined to a small-sized opening, and the hole in the cecum allows free access to the ileocecal valve if this is required.

Both these operations afford relief to patients who have suffered for many months or years with entamæbic dysentery, ample experience having demonstrated the clinical merits of these methods, as evidenced by the marked improvement that takes place. Bed cases, as a rule, are gotten up and about; diarrhœa gives way to formed or partially formed stools, and when severe constipation is present, the irrigation insures a daily evacuation. Blood and mucus are notably lessened; strength increases, and patients have restored to them, more or less, the pleasure of living.

To bring about these results in cases that have persisted for long periods it is imperative that the irrigations be carried out daily without fail, and for an indefinite number of years. Even in the most favorable late cases, should the irrigations be missed for several successive days, the bowel may revert to its former condition, and the patient again starts on the decline. The catheter and the fountain syringe become indispensable articles of the daily routine if comparative comfort is to be maintained. I have followed the later history of a number of cases so treated during the past six years, some of them selected among cases of long standing, and considered as being particularly favorable for this form of treatment, and in none has it proved more than a palliative measure. When treatment is discontinued for a time, or when the appendiceal or cecal opening is allowed to close, either by design or through carelessness, there is a quick return of the symptoms. This is the experience of others who have tried these methods, yet these operations are considered by many as offering the last hope for cure in chronic cases. A selected diet is like-

wise always demanded for these cases, and when this is departed from, and a full diet is indulged in, notwithstanding the daily irrigations, food will pass undigested and dysenteric symptoms will reappear.

These operations then in the late cases afford measures that are purely palliative—they will not cure. Although improvement is apparent, a limit is reached in the forward stage; patients never get quite well, and a discontinuance of flushing means a return to positive infirmity. The ulceration and other pathological changes on the surface and in the wall of the gut have gone too far for flushing with an entamœbicidal solution to bring about a healing process that will result in permanent cure.

If, then, the surgeon will be satisfied with attaining comparative comfort for the patient, and if he is inclined to estimate lightly the increasing glandular changes taking place throughout the body and which are characteristic of this chronic disease, and if he chooses to disregard the dangers from the constant drain of hemorrhages and of possible perforation from ulcers that persist, and if he is willing to have his patient constantly exposed to the development of a hepatic abscess and of intestinal stenosis, this treatment may be carried on year after year without hope of ultimate cure and until the patient succumbs to the disease or to one of its complications. I am not disposed to look upon the disease with such indifference or so resignedly. I believe that an effort should be made to accomplish more for the patient than a mere alleviation of his local condition and an improvement in general health; and, as these operations do not lead to permanent betterment in the delayed chronic stage, I do not consider this late stage as the proper scope of usefulness for these important accessories to treatment; nor do I think that the patient should be subjected to troublesome catheter irrigations through many years, to the annoyance of wound leakage when exercise is taken, and to the disturbing apprehension connected with an uncured grave malady. These operations undoubtedly offer valuable aid in the treatment of entamœbic dysentery, but in my opinion their performance should be limited to the mild cases that do not respond to medicinal treatment in the acute stage, and that enter on the chronic stage with subdued symptoms. If these methods are employed in this class of patients and at a time when the diseased process is still mainly confined to the surface layers of the bowel, and before gross pathological changes have taken place, they offer a splendid means of establishing a cure, and they should accordingly be carried out early in the course of chronicity, and limited to patients not greatly prostrated with the disease.

Rapid improvement, disappearance of entamœbæ from the stools after purgation, normal motions, and complete restoration to health should follow the use of these methods in the course of a few weeks. If the patient does not progress favorably in this time and a standstill is reached, or a relapse occurs, these methods should be at once supplemented with another simple operation, which should likewise be performed on all cases that remain profoundly ill in the acute stages, and

on cases suffering from relapse or a persistence of the disease in the later chronic stage.

Ileostomy.—In the severe cases that are very ill from the onset, and that resist medical treatment by mouth and rectum, it is useless to introduce a better flushing system of treatment without at the same time diverting the fecal current from the involved area. These cases are liable to develop fulminating symptoms which speedily end in death, or they tend to become obstinately chronic, so additional curative measures must be instituted without delay. The seriousness of the patient's condition is indicative of a very extensive necrotic process going on in the bowel, for it is the rule, with these cases, that the gravity of symptoms is proportionate to the extent of the bowel ulceration, and, conversely, the longer the lesion lasts, the greater the extent of the ulcers. The rapid extension of ulceration and necrosis in these cases is brought about not only by entamæbic invasion, but by the very active agency of the bacterial flora that infests the gut. Under natural conditions the large bowel is the seat of untold numbers of bacteria of serious pathological types, and in the presence of a disease process, with the decaying elements of ulceration added to the excrementitious contents of the colon, suitable conditions are afforded for the rapid multiplication of colonies. These bacteria readily attack the non-resistant bowel at the site of the primary lesion, and ulceration spreads rapidly over the surface of the gut and to the deeper layers. The substances that are elaborated during this destructive process—indol, skatol, cresol, and oxyacids—are absorbed in quick succession, and often cause the severe systemic poisoning from which these patients suffer. The kidneys become choked with these toxic products, being overtaxed to clear the system of impurities absorbed from the colon, albuminuria appears, and as the case goes on a nephritis develops and the patient is in poor condition to cast off his disease. Under these circumstances the indications are for the employment of measures to lessen the irritation of the gut by preventing the passage of fecal matter over the ulcerated surfaces, to reduce the hyperemia brought on by peristaltic effort, and to exclude from this portion of the intestine the pabulum which favors germ growth and thereby adds vast colonies of bacteria in the necrotic process. This is accomplished by the establishment of a manageable artificial anus.

Delay in making the inguinal outlet should not be prolonged by uncertainty or motives of sentiment if the case is to be saved or chronicity avoided. The utility of this procedure has been demonstrated sufficiently often to make its application unmistakable. Serious symptoms begin to ameliorate immediately after the outlet is established, and one sees a quick change in the discharges from the ulcers and from the inflamed mucous membrane. Furthermore, toxic absorption is minimized. Where, before, each frequent straining motion was accompanied by the discharge of quantities of sanguinolent mucus, pus, and necrotic tissue, tenesmus lessens, and the discharge ceases almost entirely, very little material coming away with the flushing solution from above. This is in keeping with the physiological law, as stated by Abbé, that, "when an

organ is put out of function it atrophies and ceases to secrete, and if secretion goes on, the balance between absorption and secretion is established."

In determining the part of the bowel for making the artificial anus, the findings of the postmortem table will reveal the proper point for opening the gut. Any portion of the large gut may take part in the ulceration, the cecum being a most common site. In a certain percentage of cases the ulceration goes beyond the ileocecal valve, to a limit of six inches up the ileum; so the opening must be made high enough up to sidetrack every diseased portion. Presumably the reason ulceration occurs in the distal portion of the ileum is on account of the arrangement of the blood-supply in this part of the bowel, the terminal vessels of the secondary loops from the ileocolic artery supplying the lower six inches of the ileum and the head of the colon, which distribution makes it possible for *entamoebæ* to migrate from the cecum to adjacent parts through the blood-stream. This terminal portion of the ileum should, therefore, be included in the section of the bowel that is to be given complete rest or the object of the bowel exclusion treatment will be defeated in some cases.

My plan is to enter the abdomen through the ordinary small muscle-splitting appendicectomy incision, under local anesthesia. The cecum is located, and an adjoining loop of ileum is hooked up through the wound. Manipulation of the bowel does not cause pain. If, now, no pressing need exists for opening the bowel at once, as determined by the mildness of the symptoms, a point of ileum is selected six inches (15 cm.) from the valve, and a medium-sized rubber tube stiffened with glass tubing is passed through the mesentery, the ends projecting on each side and resting on the abdominal wall. Several interrupted sutures will anchor the gut to the fascial layer. After thirty-six hours the bowel is completely divided by cautery, and a Paul's glass tube with long rubber drain attached is inserted and tied into the upper end, which carries the fecal discharge to a receptacle underneath the bed; the lower end of the bowel is inverted and whipped over in two layers, leaving an opening into the lumen at one side for a rubber catheter, which is snugly anchored in for irrigation.

In the fulminant cases the bowel should be divided at once. To avoid all risk of peritoneal infection an adaptation of Stewart's method is substituted for Paul's tube in this case. A clamp is placed at either extremity of the loop of ileum as soon as it is delivered and the bowel is divided. One-half of a snugly fitting Murphy button is inserted into the upper end, and the cut end of the bowel is tucked over the flange. The other half of the button is squeezed into a rubber tube, the diameter of which is somewhat smaller than the flange of the button. The two parts of the button are then clamped, the intestine is sutured to the wound margins, and the feces are drained into the receptacle on the floor (Da Costa). The lower end is treated as described above, provision being made for immediate irrigation. At the end of several days, when adhesions have taken place and the abdominal cavity is firmly walled

off, the Murphy button may be removed and the Paul's tube inserted for better fecal drainage.

The advantages of this method are that it excludes from fecal irritation all portions of the gut that may be involved; it lays open to flushing treatment all possible areas of ulceration; and it can be easily performed on patients extremely ill or very much emaciated, without fear of loss of life. Bowel irrigation is carried out as described under appendicostomy, and codeine may be given to check the liquid movements. Patients thrive notwithstanding the sidetracking of the large bowel, and as the case progresses a more liberal diet may be given earlier than where an artificial anus is not provided, the only precautions necessary being the selection of such foods as are easily digested and absorbed. If the ileostomy is done later in the course of chronic disease, after the patient has been subjected to a trial of simply flushing by means of appendicostomy, the appendiceal opening may be allowed to close, or the appendix may be excised, or if no ulceration of the ileum is found to exist, the lower end of the ileum may be completely closed and the appendix continue to be utilized for subsequent irrigations.

The cecum has been made use of in some instances for making the artificial outlet. The method consists of making a three-inch incision directly into the abdomen over the cecum, which is fastened to the wound on each side, opened, sponged out, and irrigated, the opening being sufficiently large to allow the contents of the cecum to be evacuated. The objections to this method are that it utilizes a portion of the bowel that is commonly involved in the disease, and which is, therefore, not given complete rest, as fecal matter is permitted to pass over ulcerated surfaces; the ulcers in the cecal rugæ are not so amenable to a thorough flushing treatment, as the cecum under such conditions is usually puckered up into folds and some ulcers will escape attention; and if there is any ulceration in the ileum, it is likely to persist and cause a recrudescence of symptoms after the case is believed to be cured.

The ileostomy opening should be continued until there is assurance that all ulcerated surfaces are healed over. This will be indicated by cessation of all evidences of pus and blood-stained mucus and entamœbæ, after repeated microscopic examinations, and a corresponding improvement in the general condition of the patient. A repair operation should then be done under general anesthesia; the adherent ends of the cut bowel are separated from the abdominal wall, the margins freshened, and both ends completely closed by running sutures. The upper segment is anastomosed laterally to the ascending colon by a simple suture method, and the abdomen is closed without drainage. When the wound is healed, the patient should be fit to resume his vocation under any conditions.

Colectomy.—Some cases of entamœbic dysentery will keep on in the chronic stage, and no matter what measures are instituted for their relief, nothing will stem the inroads of the disease. These cases become extremely emaciated and hopelessly bed-ridden, suffer from continued tenesmus, bloody discharges from the bowel never cease, and eventually

they die in great misery, mere skeletons of their former selves. Having witnessed upward of one hundred necropsies on these deplorable cases, the hopelessness of effecting a cure of the bowel lesions in the advanced stages of a desperate case has been thoroughly impressed upon me. The bowel changes appear not unlike those of malignant disease. Some portions of the large gut are practically disintegrated, and other portions are greatly thickened, with deeply ulcerated walls, and with intestines matted together over local pus collections where perforations have taken place. Indeed, one wonders how these cases survive through many months of such serious pathological intestinal changes.

As cases of so grave a nature inevitably terminate fatally under present forms of treatment, the question arises as to whether a radical operation, which includes excision of the entire diseased colon, is justified in cases of this kind. While I do not feel that I can make positive statements on the advisability of so radical a procedure, I believe that surgical treatment of this character will prove a means of saving many of those cases that otherwise are destined to die. Certainly it is the most logical procedure in cases where the disease has involved so large an area as to prevent any attempt on the part of nature to repair damages; and where toxic absorption from an area reaching such a compass overwhelms the system, it is the only rational method in dealing with the malady. After a thorough trial of an artificial outlet and colon flushing for several months, if the patient does not show signs of gaining ground, I believe that the indications call for a complete removal of the diseased gut down to and including part of the sigmoid, and at a time before the patient reaches the stage when he is too feeble to avail himself of his only chance of a life of comfort. I will go a step farther, and say that I consider complete removal indicated in those long-standing cases of ulceration and bowel changes that leave the patient in a state of semi-invalidism with emaciation, tenesmus and dysenteric stools continuing through numbers of years. The ileostomy outlet will have prepared the patient for colectomy, and experience has taught that the two-stage principle is a reasonably safe method in colon excision. The greatest dangers of the operation are from prolonged vomiting and shock, but the former can almost entirely be avoided by preoperative intravenous injection of two litres of normal saline solution, and the latter can be greatly lessened by careful rapid work and the administration of the least amount of ether. These precautions and a decision to operate before advanced systemic poisoning and emaciation have set in should result in a mortality sufficiently low to warrant the procedure in a large number of cases that are now considered hopelessly incurable.

Should, then, the patient be losing ground after a thorough trial of drugs, colon flushing, and an inguinal outlet, resort is had to a colectomy. Under general anesthesia the distal end of the ileum is freed from its attachment to the abdominal wall; the abdomen is opened in the median line, and the entire colon is excised, including the greater portion of the sigmoid, which is divided low down, the distal end being closed by suture. The dangers of infection will be minimized by the use of a rubber dam

when the intestine is divided and sutured, and by drainage at the lower angle of the abdominal wound, which is otherwise closed in layers. Any ulceration that exists in the rectum can be treated locally through a proctoscope during convalescence, and when the patient will have had advanced sufficiently in the recuperative stage to warrant a restoration of intestinal continuity, the abdomen can again be opened, and the freed end of the ileum implanted laterally into the sigmoid stump by means of a Murphy button or by Doyen's clamps and suture. The final closing of the abdominal wound completes surgical efforts for the patient, and with proper dieting he should be able to live his natural life in comfort. Should the recuperative powers of the patient be so low as to prevent an early return to complete health, the patient should be given the benefit of a change to a more bracing climate. The change, however, should not be made during the winter months. If this is unavoidable, the utmost precautions should be taken to prevent his being chilled; and the selection of suitable warm clothing will be a matter for the special consideration of the physician under whose care the patient may fall.

Complications and Sequels.—Perforation is an infrequent complication, and its occurrence is most commonly noted in gangrenous cases. The most common sites of perforation in order of frequency are the sigmoid flexure, rectum, cecum, transverse colon, and hepatic flexure. Serious hemorrhage is of infrequent occurrence and seldom causes a fatal termination, the bleeding usually ceasing when the local area becomes well depleted. Stenosis is a rare sequel, but is occasionally met with, and follows cicatricial contraction of healed ulcers, particularly those located at the narrowed entrance and exit of the sigmoid colon. The treatment of these several conditions is similar to that referred to under the treatment of bacillic dysentery.

The most usual complications are hepatitis and hepatic abscess. They may arise at any stage of the disease, in a dysentery of any grade of severity, that is either active or latent. Both are usually limited to tropical infections in white adult males, natives appearing to have a considerable racial immunity to these complaints.

Hepatitis is the forerunner of the suppurative complication, hence the recognition and successful treatment of the former insures prevention of the latter. Hepatitis is accompanied by a distinct type of fever, of a chronic intermittent type, which persists from one to four weeks before the organ suppurates, and by blood changes that are diagnostic: there is always a moderate degree of leukocytosis, but the proportion of polymorphonuclears is either normal or only slightly in excess—usually from 70 to 80 per cent. The local symptoms are usually acute and well marked, but in exceptional cases may not be very definite, particularly when the affection comes on insidiously with fever and sweats during the later or convalescent stages, or when dysenteric symptoms are in abeyance. The hepatitis is due to the invasion of the organ by the entamoebæ introduced through the portal circulation, and the best treatment is to administer ipecacuanha in the manner described for the acute stage of the dysentery, the beneficial effect of the drug in the manage-

ment of the complication being equal to that attained with the intestinal disease. Ipecacuanha administered in sufficient dosage to obtain its full therapeutic effect will, in the course of two to six days, bring about a cessation of all hepatic symptoms—pain and tenderness cease, leukocytosis disappears, pyrexia drops to normal, and the organ is restored to its former size. The drug thus acts not only as a cure for the liver inflammation, but as a preventive to abscess formation, and, suppuration being averted, the patient is saved from one of the most dangerous maladies of the tropics. A course of the drug in small doses should be given for two weeks after the symptoms disappear, to ensure complete eradication of the infection from the liver.

In the event of failure to recognize the hepatic condition prior to the development of suppuration, the next important thing is to diagnosticate the abscess formation early. The abscess is slow in developing and long in continuing, and the longer it continues the greater will be the systemic depression and exhaustion, and the less likelihood will there be of the patient's recovery, even though aided by evacuation. The suppuration is dependent on the action of the entamoebæ on the hepatic cells, and the abscess formed is the prototype of the initial lesion in the wall of the intestine. When the abscess is small and is limited to the parenchyma of the gland, the thick, viscid content and the scrapings from the abscess wall will be free from cocci and bacilli; and when, in abscesses of large volume, encroaching on neighboring structures, these bacteria are brought by the blood-stream from the intestinal canal to the spreading margins of the specific destructive process, the bacterial inflammation resulting will give increased gravity to the morbid condition. As the pus collection increases in volume these inflammatory changes will take place on the surface of the organ, adhesions will form, neighboring viscera will become involved, and in advanced cases rupture may take place into the adjoining cavities. With these advancing changes there is an increased toxic absorption, and should the recognition of the ailment be long delayed, the patient will be in poor condition to withstand operation and to undergo recovery.

The importance of the early diagnosis of the pus collection, and the bearing it has on the ultimate outcome in the management of the case, is well illustrated by the results obtained in a series of 49 cases of hepatic abscess that have come under my care during the past twelve years. Of this number, 25 came to operation with the organ far advanced in suppuration, with pus-collections ranging from one to six pints (500 to 3000 cc.) in volume, and with neighboring structures more or less seriously involved, (in 2 cases rupture had taken place into the lung, in 1 case into the colon, and in the others a number were on the verge of rupture); 12 of these cases terminated fatally from one day to three weeks after operation. In the remaining 24 cases the pus-collection was recognized early, the abscesses varying in size from a walnut to a small orange, and confined to the liver substance; operation was followed by recovery in each instance. The abscess can be readily diagnosticated in its incipient stage if a careful

investigation is made of the signs and symptoms associated with early pus-formation in the organ. This matter was set forth in a previous article (*Annals of Surgery*, May, 1904), wherein a series of diagnostic points were set down characterizing the early stage of the malady, and if these points are observed, very few cases should escape to the advanced stage of large pus accumulation and neighboring visceral involvement.

Having determined the existence of pus in the liver, the management of the condition becomes essentially surgical, and this comprises two important steps: the first is to ascertain the number of abscesses and their exact location in the liver lobes, the second is to thoroughly evacuate and drain them. In about three-fourths of cases there is a single abscess, and four-fifths of these are in the right lobe; but the other lobes may be affected in single or multiple form, and as it is impossible to get definite information on these points without direct palpation, recourse must be had to an exploratory laparotomy. My method is to make an infra-costal incision one inch below the costal border, and through this opening a methodical digital examination of the liver is made, starting at the right side and examining the under surface of the organ, then withdrawing the hand and sweeping it over the upper surface, searching for any irregularities of surface or adhesions, and for the peculiar resistant tense bogginess which is an unmistakable sign of liver suppuration, and which can readily be elicited even] though the pus-collection is deep seated. When an area of pus-formation is located, the remainder of the organ is not abandoned, but the same cautious search is continued for other possible abscesses. After the pus-collection is located, two routes are offered for its evacuation—one being through the exploratory incision and the other through the chest-wall. If the abscess is located in the left lobe or in the lobulus quadratus, or in the lobulus Spigelii, or near the under surface of the right lobe, or near the upper surface of the right lobe, but near the anterior margin, it is more easily evacuated through the exploratory incision; if it is located near the upper or the posterior surface of the right lobe, drainage is more readily accomplished through the chest-wall, after a preliminary resection of a portion of overlying rib, the midpoint of the incision on the chest-wall corresponding to the centre of adhesions between liver and diaphragm. Should any adhesions exist, the reflected layers of pleura are incised, a circular suture is used to close off the lung cavity, the incision is carried through the diaphragm, gauze used to wall off the abdomen if no adhesions exist, and the abscess is opened either by knife, cautery, or a large trocar of at least 1 cm. caliber. After the major portion of the abscess content has come away, a large rubber drainage-tube is inserted and is fastened to the skin. Free bleeding from the liver is not serious, and will stop of its own accord, and the depletion will act favorably in the later restoration of the organ. During the evacuation due attention should be given to the arrangement of the gauze protection, so as to avoid soiling the abdominal cavity. Drainage should be continued until there is no further evidence of pus, and the sinus is then allowed to close—the drainage period usually being a matter of one to three weeks, depending on the

size of the abscess. This method of dealing with entamœbic abscesses leaves no pus-collections undiscovered, is comparatively safe in its carrying out, and offers the surest way to bringing about an early and complete cure.

In this connection I desire to say a word in condemnation of the use of the aspirating needle as a means for determining the existence of pus, for locating the abscess site, and for evacuating the pus content. This method carries with it considerable danger, although this matter is minimized by its advocates. The needle is liable to puncture vessels, and it may carry infected thrombi to other parts of the organ and cause new foci of pus-formation; it may infect the pleura and peritoneum, and cause serious complication to the existing ailment; the information it gives is unreliable, a negative result of puncture having no significance; it tends to indecision and to delay when the information given by puncture is negative, and this may lead to fatal termination; it will not drain infected fragments of necrotic tissue from the abscess cavity, thereby failing in the important function of drainage; and even when it is doing its best service, the results accomplished are incomplete. Altogether it is a misleading and a dangerous instrument, the handy makeshift of the careless diagnostician, and the resort of the unskilled surgeon.

Prophylaxis.—The principal measures to be adopted for the prevention of entamœbic dysentery may be summarized as follows:

1. Secure a water supply from the best possible source, and make use of a purification system that will surely intercept entamœbæ. If there is any doubt, use boiled or distilled water for all purposes. When tanks and cisterns are required for storage, tests must be made regularly to detect contamination.

2. Accomplish thorough drainage of the soil in the area habited, and prohibit its contamination.

3. Substitute, where possible, an incinerating system for privies, cess-pits, and dry pans.

4. Suppress dust and exterminate flies. It is to the dried-up spore-containing feces present in dust, as well as in water, that we must look for the propagation of the disease. These spores can be conveyed by flies and can be blown about by the wind. Inhalation of spore-bearing dust may cause outbreaks.

5. Acquire the habit of washing the hands immediately before eating, and be assured that waiters, cooks, and scullions are free from the disease.

6. Cultivate vegetables in a cleanly manner, discountenancing the obnoxious garden fertilizing methods practised in many parts of the Far East.

7. Scald raw vegetables and fruits before serving when living in countries where the disease is epidemic. Boiled vegetables and stewed fruits are safer.

8. Include entamœbic dysentery among the notifiable diseases. Educate the general public as to the infectious character of the disease, and of its existence elsewhere than in the tropics.

9. Isolate the patient and disinfect his stools.
10. Recognize the dysenteric carrier and put him under treatment. The partially cured dysenteric with symptoms in abeyance is a menace to the health of the community.
11. Restrict the invasion of tropical countries to healthy people under fifty years of age, and return them to an accustomed climate on the beginning of failing health.
12. Adhere to the same dietary in the tropics, when such is obtainable, as accustomed to in the home country.
13. Avoid undue excesses, fatigue, and exposure in tropical countries, all of which predispose to the disease.
14. Persuade residents in countries where the disease is prevalent to make a practice of closely examining their motions for blood-stained streaks of mucus, with a view to careful treatment and disinfection should such a condition be discovered.

MONADIC DYSENTERY¹

Dysentery of the monadic type is due to infection by the *Trichomonas hominis*,² or the *Lamblia intestinalis*, and occurs both in temperate and warm climates. It is brought about by swallowing the encysted forms with food and water contaminated by the fecal matter of rats, mice, cats, dogs, and sheep, which animals act as hosts to the organisms. The wall of the cyst disappears in the intestinal canal, allowing the escape of the numerous small forms, which grow to the fully developed parasites; these attack the epithelial lining, destroying it and permitting inoculation with pathogenic bacteria from the intestinal contents; ulcers are produced, which are usually limited to the large intestine, and these are associated with the passage of blood and mucus, tenesmus, toxemia, and pyrexia. When this condition occurs, the motions teem with the parasites causing the infection. The disease tends to become chronic.

Castellani's methylene-blue treatment gives the best results, cachets or pills of 2 grains (.13 gm.) each being given three times daily, with flushing enemata of the same drug in solution, 1 in 3000. The general management of the patient should include confinement to bed, proper dieting, the use of separate feeding utensils, disinfection of stools and linen, and the assurance of the entire healing of the lesions and the complete elimination of the parasite from the intestinal tract before the patient is relieved from treatment.

¹ *Trichomonas hominis*, Davaine, 1854, is a pear-shaped parasite, 18 to 25 microns in breadth, having an undulating membrane and three flagella projecting at its broad end. The cytoplasm contains an indistinct nucleus and one or several vacuoles. It reproduces by longitudinal division and encysts.

² *Lamblia intestinalis*, Lambl, 1859, is an actively motile, pear-shaped parasite, 5 to 12 microns in breadth, having a thin periblast, and a cup-shaped hollow on the ventral surface by means of which it fixes itself to intestinal epithelium. It has a dumb-bell shaped nucleus and four pairs of flagella, one pair arising from the posterior end, and the others from the sucker-like peristome. Reproduction takes place by longitudinal division and by encystment with multiple nuclear division.

BALANTIDIC DYSENTERY

Infection by the *Balantidium coli*¹ occurs in Central America and the West Indies, the Philippine Islands, Japan, and Europe. The clinical manifestations of the disease resemble those of a chronic intestinal catarrh ending in ulceration of the large intestine. Hemorrhages are frequent, emaciation is marked, and there may be diphtheritic discharges in the very severe cases, which usually end fatally. As a rule, the disease runs a chronic course, sometimes lasting for years, with balantidia ever present in the mucosanguineous stools. Strong has made a collective study of this disease, and estimates the mortality at 30 per cent.

In the absence of any known specific the treatment advised by Castellani will give the most satisfactory results in ameliorating symptoms and in checking exacerbations. This consists of large rectal enemata of methylene-blue solution, 1 in 3000, and the internal administration of the same drug in 2-grain (0.13 gm.) pills. The intestinal antiseptics usually recommended are of no avail in this disease. When in any case the disease tends to become chronic, surgical intervention should be contemplated along the lines advocated under entamoebic dysentery.

LEISHMANIC DYSENTERY

The invasion of the colon by the *Leishmania donovani*² during the course of an attack of Kala Azar is not uncommon, and gives rise to one of the most deadly diseases of the tropics. The intestinal ulceration which takes place is manifested by dysenteric symptoms, and these become an integral part of the later stages of a systemic disease which is already very chronic and exhausting. The dysentery is of a severe type, and while the parasites are found in the walls of the ulcer; they can seldom be recovered from the feces during the course of the disease.

There is no known specific for this terribly fatal disease, hence the treatment of the dysentery is limited principally to cleansing enemata,

¹ *Balantidium coli*, Malmsten, 1857, is an oval-shaped bursaridium, covered with cilia, which give it a striated appearance under the glass. It is 0.06 to 0.1 microns long by 0.05 to 0.07 microns in breadth, and possesses a compact, kidney-shaped macronucleus and a globular micronucleus. Its constant habitat is the rectum of pigs, where it develops asexually by transverse division and by conjugation. It may shed its cilia and encyst, and in this condition passes from pigs to man; it is actively motile in the intestinal canal of man, entering the mucosa, in which it migrates, and causes ulcers about 1 cm. in diameter, which may be distributed throughout the entire length of the large gut, but more commonly are limited to the cæcum and ascending colon. The ulcers frequently go on to perforation. The appearance of the ulcers and the morphological relations of the parasites to the ulcers are similar to those of entamoebic infections. The parasites are found in large numbers in the stools and in the scrapings from the ulcers, in the bloodvessels of the submucosa, and scantily in the mesocolic lymph-glands.

² *Leishmania donovani*, Leishman, 1900, Donovan, 1903, is a rounded or pyriform, flagellated parasite, 2 to 3.5 microns in length by 1.5 to 2 microns in breadth. It has a granular cytoplasm containing one rounded chromatic mass which stains slightly, and another rod-shaped one which stains deeply. Multiplication occurs by simple fission. It is the specific cause of Kala Azar, and its complicating dysentery. The disease is probably transmitted by the bed-bug, *Cimex rotundatus*, in the midgut of which the parasite develops to flagellation and rosette formation. The distribution of the parasite within the human body is general, its principal habitat being the endothelial lining of the bloodvessels and lymphatics.

sustaining measures, segregation, and good nursing. The extreme exhaustion caused by the systemic disease seriously handicaps the physician in dealing with this distressing complication. Of the innumerable drugs that have been tried, atoxyl appears to be the one giving decided benefit when it is pushed to its physiological limit—about 10 grains (0.65 gm.) a day. Caution must be observed in its use, and failing eyesight or signs of gastric disturbance are signals for its discontinuance. Quinine, formerly used generally in the treatment of this condition, is now regarded as absolutely valueless. Manson advised antimonial preparations, and Rogers a staphylococcus serum, but neither agent has met with success; so also with bone-marrow and injections of soamin. The mortality ranges between 70 and 90 per cent., and when a cure results, nature must be conceded to be the successful physician. Prophylaxis is most important and should include the extermination of bed-bugs, the washing of beds and clothes with strong boiling carbolic solution, and the isolation of the sick on non-infected sites. When it is feasible, buildings in which the disease has occurred should be destroyed and the sites purified by fire.

PLASMODIC DYSENTERY¹

Malarial infections sometimes produce the clinical symptoms of dysentery—that is, the passage of bloody and mucoid stools, the ascribed cause being a localized collection of parasites in the terminal vessels of the mucosa, which cause destruction of tissue, resulting in superficial ulcerations. This form of dysentery is likely to be accompanied with much algidity and prostration, and a tendency to collapse, and unless energetically treated, rapidly results in death. Necropsy on a case succumbing in this condition shows an ulceration of the mucosa of the cecum and ascending colon, the submucosa not being involved.

In dysentery outbreaks occurring in malarial districts, or in the presence of anomalous symptoms in dysenteric cases, it becomes essential to examine the blood for plasmodia. A good rule, followed in the Services, is to make a routine examination of the blood of every case of dysentery occurring in the tropics or in malarial regions. It follows that the presence of plasmodia in the blood of a cachectic or highly febrile dysenteric patient, with a negative examination of stools for etiological forms of protozoa, helminths, and bacilli, would indicate a plasmodic dysentery and point to medication by its known specific remedy.

After accomplishing free purging with castor oil or magnesium sulphate, quinine should be administered in full doses by mouth, 10 grains (0.65 gm.) of the acid hydrochloride or the acid hydrobromide, every four hours; or if the stomach is not tolerant, by intramuscular injections of either of these salts dissolved in distilled water. In very serious cases intravenous injection of the drug should be resorted to,

¹ This form of dysentery is due to protozoal parasites belonging to the sporozoa, genus *Plasmodium*. For a discussion of these parasites the reader is referred to the article on the treatment of malaria.

preceding each 15-grain (1 gm.) injection with a preliminary hypodermatic injection of ether to fortify the heart.

It has happened that with the dysentery due to this cause a severe hemoglobinuria has set in within a few hours after the administration of the quinine injection, but this should not deter the continued dosage with the drug, so as to be certain of destroying the parasites which will otherwise kill the patient. The prostration and collapse incident to this form of dysentery are best met by repeated saline infusions reinforced by hot drinks and hot enemata. The severity of the dysenteric attack is usually controlled within a few days, and in order to bring about a cure, not only of the intestinal lesions, but of the general systemic infection, the drug must be continued in sufficient dosage—usually 20 to 30 grains (1.5 to 2 gm.) daily by mouth will suffice—to control sporulation, and until mucus disappears from the stools. Subsequent to this, ordinary prophylactic dosage should be carried out for several weeks longer as a surety against relapse. Tincture of the perchloride of iron has proved useful during the hemorrhagic stage.

HELMINTHIC DYSENTERY

Infection with the *Schistosomum mansoni*¹ causes a form of Bilharzial disease, which is a serious menace to health in the West Indies, Central and South America, Africa, and Egypt. The most prominent features of this disease are concerned with disturbances of the alimentary canal—in most of the cases intestinal symptoms are the sole manifestations—and there arises a dysenteric affection which may be marked by considerable bleeding, severe tenesmus, abdominal distention, the slow and painful passage of feces which is always preceded by the discharge of blood and mucus, and at times by rectal prolapse.

The intestinal changes which take place are due to the activity of the ova in causing capillary blocking and inflammation in the submucous and muscular coats of the large bowel; a marked fibrous thickening of the entire wall of the gut follows, with hypertrophy of the mucous layer

¹ *Schistosomum mansoni*, Sambon, 1907, is a bisexual trematode; the male is thin and flat, 12 mm. long, has an oval and a ventral sucker, and its lateral margins are turned ventrally inward to form a canal in which the female lies. The whole body is covered with short spinous papillæ, which enable it to adhere to the walls of bloodvessels. The female is thin, 15 mm. long, with a smooth cuticle, excepting in the sucker and at the tail end, where there are short papillæ. The uterus in the mature fertilized female is stuffed with yellowish oval-shaped ova, each ovum having a thin shell and a lateral spine. The miracidium escapes by transverse rupture of the shell. The habitat of these worms is the portal system, pairing occurring in the portal vein, from which they are carried to the smaller radicles of the large bowel, in the capillaries of which the ova are deposited—the area corresponding to the muscular coat and the submucosa. The activity of the ova causes great thickening of the wall of the gut and the formation of numerous characteristic polypoid growths which bleed easily and frequently ulcerate. The ova may also reach the lungs, liver, gall-bladder, pancreas, spleen, etc., giving rise to the symptom complex of intestinal schistosomiasis. It is not known definitely whether the miracidium reaches its human host in the body of some crustacean from a contaminated water-supply, or whether entrance occurs directly through the skin. The former view appears more tenable. Up to recent years this parasite was confused with *Schistosomum hæmatobium* as the cause of intestinal schistosomiasis.

that results in the formation of papillomata and adenomata. These growths often form a dense mass in the intestinal canal which may completely fill the lumen. They bleed readily, and are bathed in mucus from oversecretion of the hypertrophied membrane. The growths are commonly diffused through the whole of the large bowel, the appendix taking part in the affection, but in some instances they remain localized in sharply defined masses bordered by apparently healthy bowel. Polyposis is the common phenomenon, and the polypoid masses often become detached by torsion or thrombus necrosis and appear in the stools. At the point of detachment ulceration results and these ulcers tend to increase in size, to bleed readily, and to remain chronic.

The condition lasts a variable number of years, the milder cases having slight symptoms that cause no great degree of distress; the more serious cases—the severity depending on a greater number of parent worms in the body—suffer frequent exacerbations with severe symptoms and great prostration, which may end in death. The malady is, however, not necessarily fatal, and if the patient can be tided over the severe exacerbating stages, his chances for ultimate recovery are good.

In the treatment of this affection we have to deal with a localized manifestation of a general disease, and while in a large proportion of cases the dysenteric symptoms will demonstrate the only apparent lesions of the disease, treatment directed solely against the bowel condition would not bring about a cure of the general schistosomiasis from which the patient suffers. As there are no known medicines which will kill the parent worm causing this infection, treatment resolves itself into a symptomatic management of the case, and we must content ourselves with relieving the patient of his intestinal distress and fostering his strength until the parent worms die and all their eggs are discharged. This occurs not infrequently, and the patient undergoes a natural cure in the course of several years.

The severity of the disease is to some extent influenced by *male fern*, and this drug should be administered at the onset of symptoms and continued at intervals for at least two weeks, or until toxic symptoms appear,—such as tinnitus, giddiness, ocular pains, epigastric distress, and vomiting. The drug is an empiric remedy, but its value has been demonstrated in diminishing the amount of bleeding, in allaying intestinal irritation, and in reducing the number of eggs passed in the feces. Although it will not cause the expulsion of the parasites from the body, it appears to lessen their power of doing harm. It should be given in the form of the fluidextract, in 15-minim (1 c.c.) doses three times a day.

Tenesmus is benefited by clysters, ice suppositories, and rectal irrigations of starch and opium. If there is a tendency to prolapse, a buffer of lamb's wool moistened with witch hazel will give relief. Free hemorrhage is best controlled by ice-bags to the abdomen and the administration of ergotin and morphine hypodermatically. Anodynes are indicated for pain, and laxatives should be given repeatedly to lessen the size of the fecal mass, and to facilitate its passage through the partially blocked bowel. When the exacerbation has subsided, tincture of the

chloride of iron should be administered in tonic doses for several weeks at a time.

It is most important with these cases to see that they are placed in proper hygienic surroundings and are given a plentiful supply of nourishing food. The patients, as a rule, come from the poorer classes, many of them stricken in poverty and addicted to squalor. They appear for treatment during an exacerbation of the disease, and on its subsidence leave the hospital to return to their former mode of living. During the weeks or months that symptoms are more or less in abeyance, filthy surroundings and lack of food work havoc with a plan that has in view the preservation of strength for the hoped for natural cure. The length of time the disease lasts precludes the possibility of using hospital wards for the maintenance of patients during the long periods of abeyance when no clinical symptoms are apparent, and if there are no facilities for segregating these cases in properly supervised colonies, it becomes necessary not only to educate the individual, who is oftentimes non-receptive to suggestion, as to the hygienic requirements of his condition, but also to see that he is provided with sustaining foods. The dietary should be liberal and should include such articles as will best build up the strength of the patient. Cold and other causes of catarrh must be guarded against, and cleanliness must be scrupulous to protect against reinfection.

Various local means of treatment have been recommended from time to time in the management of this disease, among them high flushing enemata of poisonous substances in solution; but when one recollects that the mature parasites are out of reach in the bloodvessels, that the ova are situated deeply in the intestinal wall, and that only those that escape through the mucous membrane or are exposed in ulcers will be influenced by the flushing, one can scarcely hope for any benefit from helminthoidal injections. For like reasons topical applications by means of an appendicostomy opening are unscientific and futile. Excision of the affected portion of the bowel has been advocated, but as it is clinically impossible to make a definite diagnosis of a localized affection without subjecting the patient to laparotomy, and as the great majority of cases have a diffuse involvement, the procedure would involve a primary laparotomy as a means for determining the extent of the disease in practically all cases for the benefit of a few. Furthermore, when we remember that other parts of the body are likely to be affected, removal of the affected portion of the intestine will not bring about a complete cure of the patient, so excision of the affected portion of bowel cannot be considered justifiable. For the same reason I do not consider a Whitehead operation permissible, this operation being recommended as a means of treatment in cases where the lesions are apparently limited to the lower part of the rectum, which may be prolapsed; for it is quite a formidable undertaking with these cases, and at best is merely a palliative measure, and will not influence the course of the disease in other viscera. The only conditions in which I believe operations are indicated in these cases are where polypoid masses pro-

trude from the rectum and in the event of stenosis. Not infrequently when the rectum is involved, continued straining at stool will cause the protrusion of a number of the growths from the anus. Sphincteric contraction on these growths causes severe discomfort, and ultimate relaxation favors prolapse. This condition should be met by removal of the papillomatous masses with scissors or cautery, and by multiple linear cauterizations of the exposed bowel, and replacement. Stenosis, on the other hand, is a most uncommon occurrence. One marvels at the absence of obstructive symptoms during the life of the patient when viewing the enormous number of papillomatous growths encroaching upon the intestinal lumen in the delivered specimen. The non-existence of such symptoms finds explanation in the extraordinary hypertrophy of the muscular coat of the bowel, which brings to bear a very considerable pressure on the feces, and in the excessive secretion of mucus which favors their easier passage. When such symptoms do occur, the obstructing cicatrix must be sought out and excised, or an artificial outlet be provided in the right groin.

The dysenteric disease caused by *Schistosomum japonicum*¹ infection resembles that caused by *Schistosomum mansoni*, and the treatment recommended is that set forth above, additional attention being directed to the anemia and the greater emaciation occurring in this disease.

The *Fasciolopsis buski*² not infrequently gains access to the intestinal canal of man foreigners, and natives alike, in the East, and gives rise to a dysenteric diarrhea of moderate severity. The condition is speedily relieved by the administration of anthelmintics, and the most effective of these are oil of eucalyptus and thymol. The former is less toxic, more pleasant to take, and safer for out-patient service, to which class of cases these patients usually belong. The drug should be given in combination with chloroform and castor oil. Oil of eucalyptus, 20 minims (1.5 c.c.), chloroform 20 minims (1.5 c.c.) in an ounce (30 c.c.) of castor oil should be given in the morning while the stomach is empty, the dose being repeated half an hour later, and a light diet prescribed. The dosage should be continued on alternate days until the stools are free from ova. If thymol is used, due regard must be had to its dangers, and the precautions should be observed as set forth in the treatment of uncinariasis.

¹ *Schistosomum japonicum*, Katsurada, 1904, in general appearances resembles *Schistosomum mansoni*, but is smaller. The male measures 7 to 12 mm. in length and has no tubercles; its posterior sucker is larger than the anterior, and is pedunculated; the female measures 8 to 12 mm. long. The ova are yellowish-brown in color, oval shaped, and without opercula or spines, and contain a ciliated miracidium. Nothing is known of the life-history of this parasite. It invades the same regions of the body as does the *Schistosomum mansoni*, and causes marked fibrous thickening of the colon from cœcum to anus, with mucous membrane erosions, patches of necrosis, and papillomata.

² *Fasciolopsis buski*, Lankester, 1857, is the largest trematode inhabiting man, measuring 24 to 75 mm. in length, and 12 to 14 mm. in breadth. It has a smooth skin without spines, and its ventral sucker is larger than the oral. The genital pore opens in the median line anterior to the ventral sucker. The testes are in the posterior half of the body, with the ovary and uterus in front. The vitellaria are well developed, and the eggs are numerous. The habitat of this parasite is the intestine of the pig and man. It causes erosions of the mucous membrane in the human intestine.

BACILLIC DYSENTERY

Bacillic dysentery¹ is found all over the world, usually in endemic or epidemic form. It is extremely common in the tropics, more especially in the dry season, when flies abound and when dust storms prevail, when drinking-water is low and easily fouled, and when bodily vigor is relaxed from the effects of the high range of temperature. It not infrequently appears in widely distributed outbreaks in the north during the summer and autumn months, and is responsible for the high infant mortality the year round in temperate zones. It is a disease of defective sanitation, and hence is common in lunatic asylums and in armies in the field. It is not influenced by humidity nor by climate, any more than that a high atmospheric temperature assists the growth of the organisms, induces bodily relaxation, and favors the formation of dust and the propagation of flies. It is more likely to supervene on famine, when lack of nourishment makes the system non-resistant to disease. It readily attacks the very young and the aged and debilitated individuals. Its manifestations are essentially those of an acute disorder, though the disease may become chronic. It does not tend to cause relapse, and when such does occur, it means an incompletely cured case. Its mortality ranges from 1 to 30 per cent., depending on whether the infection

¹The two organisms principally concerned in this form of dysentery are the *Bacillus dysenteriae*, Shiga, 1898, and the *Bacillus dysenteriae*, Flexner, 1900. Shiga's investigations in Japan during the years 1898 to 1900 led to the elucidation of the etiology of the disease by the isolation of a short, non-motile bacillus with rounded ends, staining readily with the usual dyes, asporogenous, decolorized by Gram's method, not clotting milk, and fermenting glucose only. About the same time Kruse isolated an identical bacillus in Germany. Two years later Flexner isolated from dysentery cases in Manila a bacillus which differed in several respects from the Shiga-Kruse *Bacillus dysenteriae*, principally in fermenting certain sugar media—dextrose, mannite, saccharose, and dextrin—which difference has been universally confirmed. A number of bacilli varying from these two main types have since been isolated at different times, but they have proved to be subsidiary strains; among them the Hiss *Bacillus Y dysenteriae*, which, in addition to glucose, ferments mannite; the Strong *Bacillus dysenteriae*, which ferments mannite, saccharose, and dextrin; the Harris *Bacillus dysenteriae* and the Wollstein *Bacillus dysenteriae*, both of which ferment mannite, saccharose, maltose, and dextrin; and the Castellani *Bacillus paradysenteriae*. These varieties are of less importance than the two main types as they are not so widely distributed, being found only in local restricted areas. The Shiga *Bacillus dysenteriae* has never been isolated from the normal intestine, whereas the other types, *i. e.*, the mannite fermenters, have been so isolated, and this has led to the belief that the latter may be normal inhabitants of the intestinal tract, while the original bacillus represents a true parasite, especially so as the Shiga *Bacillus dysenteriae* is more highly infectious; but the constancy of one or the other of the mannite fermenting types in dysentery endemics to the exclusion of other types, the increasing number of these organisms in the discharges, the presence of agglutinative reaction, and the close relationship of the bacilli to the intestinal wall, warrants their classification as etiological factors. The bacilli may be recovered from the stools by making a smear of a shred of mucus over a plate of MacConkey's bile,—salt-lactose-neutral red-agar;—the growth forms a slightly elevated, translucent, whitish layer, thinner at the periphery and with slightly scalloped edges. Recovery of the bacilli is effected with greater difficulty in the chronic cases than in the acute. The morphological characters are similar in all the types. The different bacilli may be identified from one another by their dissimilar fermentative action upon carbohydrates, by agglutination, by conglutination, by complement fixation, by Pfeiffer's reaction, by Castellani's absorption method, and in less degree by their pathogenetic action in animals.

is from a subsidiary variety or from a main pathogenic type, upon environment, and upon the character of treatment.

This form of dysentery includes a number of ailments formerly of vague nomenclature, and of unknown cause. The dysenteries termed catarrhal and the fulminant dysentery of the tropics that appear coincident with entamœbic outbreaks, but without entamœbic etiology, have now definite classification under this heading. The summer diarrhœas of infants and cholera infantum are now recognized as dysenteric disease caused by a specific bacillus belonging to this group. The epidemic colitis of asylums, jails, and communities at large is now known to be bacillic dysentery, and the camp diarrhœa of armies is no longer an obscure affection. The sporadic cases of winter diarrhœa that appeared for unknown reasons have been proved to be of specific bacillic origin, and these cases are the carriers of the disease through a period of low temperature to the favorable conditions of warmth, when they become the means of spreading the disease, starting the annual summer epidemic.

The disease is distributed by the dejections of people in whom the infection exists in a mild and unrecognized form, by those entering on a severe attack but who are not yet under treatment, and by convalescents released from treatment before the bacilli have entirely disappeared. The germs are conveyed to the mouth by means of food and drink and eating utensils, through the agency of flies, dust, and surface washings, and by uncleanly hands or contaminated substances. Flies are probably the most common means of transmission, and the bearing of these insects on the spread of the disease was duly emphasized by the investigations of Auché in 1906, who found that house-flies may take up the dysentery bacilli from pure culture or from the stools of dysentery patients, and carry the bacilli in a living state for some hours, and then, by alighting on suitable culture-media, produce successful inoculation with growth of colonies. It is a notable fact that the epidemics of the disease occur in fly time.

The ingested bacilli pass to the intestine, where they grow and multiply, giving rise to a powerful soluble toxin,¹ which is both excreted and absorbed into the blood from the intestine, and which produces intestinal changes of varying grades of severity.

In some cases of clinically certain bacillic dysentery no intestinal lesions of consequence are found at postmortem. Particularly is this true of many of the acute dysenteries of children, where one or more of

¹ Shiga claims that the soluble toxin consists of two components: (1) A neurotoxin which produces paralysis of the legs and bladder and severe hemorrhages in the cord, and (2) an enterotoxin, which causes the dysenteric changes in the bowels, these claims being based on experimentation on rabbits. A study of the spinal cords of 35 patients dying of bacillic dysentery was made by Southard and McGaffin, and they failed to demonstrate the existence of similar lesions in the spinal cords of human beings. The symptoms that might be attributable to a neurotoxin component (headache, numbness, insomnia, stupor, delirium) may occur simultaneously with other symptoms (fever, muscular pains, malaise, epigastric distress, etc.), which are prominent in the severe cases where the intestinal changes involve the small intestine and the upper portion of the large intestine, and in clinical management it would appear impossible to differentiate symptoms according to their production by different toxic components.

the various types of the specific organisms have been isolated from the stools, and yet the intestine fails to show evidence of structural lesions greater than a hyperemia of portions of the small and large intestine, with exudation of lymph into the submucous coat. The changes commonly noted at necropsy range from these milder evidences through the degrees of hemorrhagic lesions and pseudomembrane to profound ulceration and enormous thickening of the bowel-wall.

In some cases the small intestine appears to bear the brunt of the inflammatory process, the mucosa of the ileum being swollen dull red, in some instances covered by a necrotic membrane, and with Peyer's patches much injected and swollen, some of them ulcerated; in others the small and large intestines are uniformly congested, the solitary and agminate follicles of the colon being red and swollen with umbilicated yellow summits, or the cecum and colon show granular hemorrhagic areas with pseudomembrane; in still others the small intestine may be reddened throughout, containing blood-stained mucus, and the colon be riddled with superficial ulcers, some with necrotic bases and walls not elevated, and others with clean bases and definite borders with surrounding zones of hemorrhagic mucosa. In some cases I have seen denudation of one-half of the mucosa of the lower portion of the colon; and again the grossest changes may be manifest, the entire colon wall being thickened for half an inch or more, with deep irregularly ulcerated areas, some penetrating to the serosa and surrounded by large stretches of pseudomembrane. While the large bowel is subject to all grades of involvement throughout its entire length, and the grossest changes are usually found in this gut, the disease is not necessarily limited to this portion of the intestinal tract; the small bowel is equally liable to take part in the specific process, and as may be judged from its great extent of absorbing surface, the more extensive this process is in the small gut, even though the gradation may be limited to a hyperemia, the more prominent are those symptoms which are usually embodied in the term "typhoid dysentery." It is, therefore, apparent that the reaction of the patient and the issue of the disease depend not so much on the degree of ulceration in any one part of the bowel as upon the amount of mucous surface that is involved in the toxic process throughout the entire intestinal tract. As a matter of fact those cases of marked changes in the large gut that come to autopsy with deep spreading ulcers and great thickening, seldom exist without visible concurrent lesser lesions in the small intestine; and these changes are not limited to the ileum, but may extend as high up as the duodenum; so that in arriving at a correct clinical conception of this form of dysentery and as a guide to its treatment, the importance of the areas of gross lesions in the large bowel should not be overestimated at the expense of the extensive toxic changes that take place throughout the small intestine; for the edema, hemorrhagic lesions, and superficial necrosis represent the active influence of the powerful toxin given off from the infecting bacilli, whereas the large areas of ulceration, having their genesis in toxic necrosis and infarction from vessel thrombosis due to endothelial shedding caused by the toxin, are

dependent for their spread upon the invasion of the ordinary destructive bacteria from the normal flora of the fecal content.

In undertaking treatment it must be realized that primarily we are dealing with a toxemia which will be more or less violent according to the type of the infection and the extent of surface involved in the toxin elaboration; that ulceration is not necessarily present, even in cases of fatal bacillic dysentery; that when ulceration occurs, as it commonly does, it is primarily a toxic phenomenon, but its development is an extrinsic condition, superimposed on the initial necrosis by the inroads of non-specific organisms.

Acute Stage.—Serum Treatment.—Given an acute infectious disease of known specific cause, and with lesions and symptoms dependent upon recognized toxin formation, it follows that the administration of an immunized serum should prove valuable as a curative measure. Shiga initiated this rational plan of treatment of epidemic dysentery of the Shiga *Bacillus dysenteriae* type, and made use of a serum derived from horses repeatedly inoculated subcutaneously with an emulsion of the isolated bacillus in a normal saline solution which had been heated to 60° C. Shiga found that this serum was both bactericidal and antitoxic, and when used early in the course of the disease,—during the first three days, when toxic symptoms were becoming manifest and the stools were taking on their bloody, mucous character,—it brought the attack to an abrupt termination in a number of instances. As some seven days of symptoms are required for the production of ulceration, the cure of the disease was thus effected before the advent of gross lesions. When the serum was administered at the end of the first week, its action was not so pronounced, but here, too, the symptoms were decidedly ameliorated, the number of stools diminished, tormina and tenesmus decreased, the temperature dropped, and general improvement followed, with recovery usually after a week's treatment. The mortality was reduced to less than one-half that usually obtained by drug treatment of the epidemic form (22 to 26 per cent. to 9 to 12 per cent.).

In 1907, Vaillard and Dopter likewise produced a serum by injecting horses with living cultures and toxins of the Shiga *Bacillus dysenteriae*, and used it as the only curative agent in 96 cases of bacillic dysentery (50 of these were mild, passing 15 to 20 stools a day; 18 were severe, passing 30 to 80 stools a day; 24 were dangerous, passing from 80 to 150 stools a day; 4 were looked upon as fatal, passing from 150 to 230 stools a day); only one death occurred. The efficacy of the treatment was shown by the disappearance of colic and tenesmus soon after the serum injection, the cessation of bleeding, the prompt decrease in the number of stools, and the rapid return to health. The mild cases were apparently cured in from two to three days, the more severe ones in from four to six days. The dosage, 20 c.c. to 100 c.c., was regulated by the gravity of the case as judged by the number and character of stools and the general symptoms of intoxication. Other observers, notably Flexner and Kruse and Duval, have had equally beneficial results with serum treatment in the early stages of the disease.

As epidemic dysentery proper, such as that in which serum therapy was used by these investigators, represents the most pronounced type of the disease, based upon its morbid anatomy, the value of the immunized serum as a curative agent has been definitely established in this type of infection. The great drawback to the practical adaptability of this form of treatment to all cases of bacillic dysentery has been in the variety of organisms causing the infection. As serum immunized against one type of organism will not be successful against other varieties, a complete etiological diagnosis would be essential in each case. Were a monovalent serum to be used, this would necessitate keeping on hand all known strains of the bacilli, the plating out of colonies from the feces of the patient, and the agglutination of cultures to determine the causative type. Manifestly this would be most impracticable, as the patient would most likely succumb to a serious infection before treatment could be carried out. Agglutination tests—trying out the various dysentery bacilli on the patient's blood to see with what strain it agglutinates in order to ascertain the kind of serum that would be indicated—would be of no value in the early days, for agglutination does not appear until two or three weeks after inoculation, and then it is often poorly marked.

In order to overcome these drawbacks, and to obtain a serum more practicable for the treatment of these cases, Shiga, in 1906, prepared a polyvalent serum by alternate immunization of horses with three strains of bacilli represented by the Shiga, Hiss, and Harris organisms, and found it equally effective against all varieties of infection. Since then various polyvalent sera have been prepared in laboratories from the different strains of the bacillus, and have become available for general use. Serum thus prepared has probably a complex action, being at the same time antitoxic and bacteriolytic against all varieties of the organism, and furnishes the blood with opsonins and bacterioprecipitins, which are markedly lacking in severe infections. A serum of this order should prove the ideal treatment for the acute stage of the disease, and it should be used at the earliest possible moment on the appearance of symptoms, and in large doses, frequently repeated, until toxic and bacteriolytic action is controlled. As there is not yet sufficient data available on the efficacy of a polyvalent serum against all types of infections of every grade of severity and in any locality, a final opinion on its full value cannot be given at this time.

Case Management.—It is important that at the onset of symptoms and immediately the condition is diagnosticated, the patient be properly isolated and that measures be instituted for the disinfection of discharges, bed-linen, and other fomites. The isolation should preferably be complete, in a room thoroughly screened from flies, with separate sick-room paraphernalia, and with special attendants who will have no duties with any person not suffering with the disease, either in the handling of food or otherwise, and whose duties will be confined to a single case during all hours of the day and night. In this way a positive security is effected against spreading the disease by contact and fomites, and it is particularly desirable that these restrictive measures be used with cases treated

outside of hospitals, and where difficulty is experienced in restraining the solicitous attentions of people untrained in nursing. For economic reasons a complete isolation is very often impracticable, and in such case a partial isolation should be effected, with the patient screened against flies, having a separate bed-pan, irrigating apparatus, etc., and with separate rubber gloves for the nurse for each case attended. This plan is especially applicable to the treatment of dysentery cases in hospital wards, and a number of patients can thus be cared for by a single skilled and reliable nurse without risk of spreading the disease to others, each patient being practically isolated from the public and from every other patient by this means. However, when this plan is used, the details of segregate nursing must be carried out without error, and the success of the plan will depend entirely on the responsibility of the attendant and the scrupulous manner in which isolation details are carried out with each patient. I knew of an instance where a dysentery outbreak was precipitated in a ward by an imperfectly cleansed douche-bag nozzle being used promiscuously; which emphasizes the necessity not only of having individual nursing paraphernalia, but that their use be limited to the individual, and that the attendant be skilled in methods of cleanliness and reliable in their practice.

The epidemic disease usually begins with an attack of abdominal pain and an increasing desire to defecate, which soon develops into a decided tenesmus and the passage of mucous and bloody stools. By the third day the evacuations are nearly pure mucus and blood, and are passed in quantities of an ounce or two every ten or fifteen minutes. In the mild cases the number of movements may be but one or two an hour, but in the more serious cases the stools become thinner and assume a watery, albuminous consistence, with a typical dirty brown color, and the number of motions may average from fifty to one hundred in this length of time. The very ill case will soon be profoundly exhausted from the frequent evacuations and abdominal distress, and every effort must be made to economize his strength. As there is no way of telling at the onset whether the infection is mild or severe, the same sick-room régime should be carried out in all cases stricken with the disease, no matter what degree of gravity they subsequently develop. The first essential is to give the patient absolute rest in bed, making use of a portable urinal and a bed-pan, and instructing the attendant that when it is necessary to change the patient's position, it must be done without causing him any individual effort. When these patients die, the immediate cause is generally a myocardial weakness from the effects of toxin absorption, so any strain on the heart muscle that might be induced by muscular effort or by upright posture must be avoided. As the slightest movement is liable also to cause a desire to go to stool, he should be handled with the utmost gentleness, and his position changed as little as possible. Draughts having the same tendency, he should be warmly covered, and a warmed pan should be placed under him when there is call to stool, with the least disturbance of the bed covers. The frequent motions are liable to cause considerable irritation about the anus, and it

will be found that cotton-wool moistened with a warm boric-acid solution is a soothing substitute for sanitary paper. At times relaxation of the sphincter occurs and the rectum may prolapse; when this happens, the bowel should be replaced with an oiled gloved hand and a buffer of wool placed snugly up against the anal fossa between the calls to stool.

Drug Treatment.—The organisms causing the disease are confined to the intestinal tract, this being essentially an enteric disease, the few bacilli that escape into the circulation having no noteworthy significance in the progress of the case, so the indications call for the removal from the intestine of the specific bacteria which elaborate the toxin and cause the lesions, and the limiting of the amount of fecal food residue which in capacious amounts would be a source of irritation to the diseased bowel surface and furnish a favorable pabulum for the propagation of germ growth. The former indication is best met by the repeated administration of saline aperients to flush the intestinal canal from above, and the latter is accomplished by selecting an especially adapted dietary.

The most satisfactory eliminant drugs are the sulphates of magnesium and of sodium; the action of these salts depends on fluid abstraction from the intestinal wall, so that by their use toxins and bacilli are washed out from the tissues, in the process of the outpouring of fluid into the intestinal canal, and will be flushed away with each evacuation. My preference is for the magnesium salt, as its action is more decisive, and I give it in an initial dose of a rounded tablespoonful (20 gm.) dissolved in 2 ounces (60 c.c.) of hot water, to which is added 1 dram (4 c.c.) of expressed lemon-juice. When the purgative action from this dose has been obtained, usually after three or four hours, the drug is given in dram (4 gm.) doses dissolved in a little hot water and lemon-juice, and is administered every hour or every two hours, depending on the seriousness of symptoms and on the effect it has on the fecal discharge. If blood and mucus diminish slowly, the more frequent dosage is given, but if the stools turn to a muddy consistence, the dose is given less often. The drug may be continued for a week or more, the intervals of administration being increased as the symptoms abate and the stools continue to improve. I have found it is a mistake to discontinue the drug too early, for constipation will come on, with a reappearance of mucus, and the cure is more certain the greater the number of evacuations in the course of the administration. At the same time there is no use in pushing purgation beyond a reasonable limit or a dangerous prostration may result. Each patient will have more or less his own index of tolerance in dosage, but administration should rather be on the side of overdosage than on hesitant insufficiency. In the milder forms of the disease this treatment leaves nothing to be desired, and in the more severe infections it will be found the most satisfactory therapeutic method in controlling the toxemic symptoms and in remedying the character of the dysenteric discharges. In the milder cases the bloody or slimy stools will revert to normal movements within three or four days after the first appearance of the disease, but the average time in accomplishing this with the more serious cases

is a matter of twelve or fourteen days, the maximum time being about two months.

When the stools retain a dysenteric character toward the end of the first week, it is a good plan to use as an adjuvant to the aperient treatment high flushing enemata, to assist in the cleansing of the bowel. Irrigations by the rectum will necessarily have no direct influence on the diseased process in the small intestine, but they will remove accumulated necrotic material from the lower portion of the large bowel, and as ulceration, when it occurs, is commonly marked in this portion of the gut, they will keep the ulcerated area of this portion measurably clean and thereby assist in healing. If used in copious amounts of 2 or 3 litres, and pains are taken to train the colon to tolerance, the entire large bowel may be flushed in this way, the rubber irrigating tube being inserted beyond that portion of the sigmoid colon which Cantile has described as the sigmo-rectal pylorus, the patient's buttocks being elevated on a firm support, and the fluid being allowed to trickle through the tube no faster than an ounce (30 c.c.) a minute. It will be found that the irrigations will likewise have a beneficial effect on the character of the stools, as the volume of fluid reflexly excites the secretion of bile to a remarkable degree, this secretion being usually very much diminished in bacillic dysentery, and the normal disinfectant will be restored to the entire intestinal canal.

I have tried a number of different drugs in solution for irrigation purposes, and experience has led me to discard all irritating chemicals. When silver, copper, mercury, aluminium, etc., are used, at times they appear to do good, but more often the mucosa is injured by these irritants and healing is delayed. I have found a normal salt solution is the most satisfactory, as it is non-irritating to the inflamed membrane, and being alkaline, its solvent action on mucus helps to detach and bring away patches of adherent pseudomembrane and decomposing tissue, thereby leaving the mucous membrane and ulcer surfaces cleaner and offering better chances for healing. It should be injected once a day—or, better, twice daily if the patient will not be prostrated too much by the disturbance incident to the lavage—and the injections should be continued until all traces of mucus and blood have disappeared from the feces.

The salt solution is likewise the best means to alleviate thirst that is so marked in the serious cases. The frequent passages drain the fluids from the body, and the severe toxemia causes a rise in temperature from 101° to 104° F., which leaves the tongue and throat dry and parched, and gives the patient an uncontrollable desire for water. This symptom is particularly aggravated by the vomiting that is associated with profound infection. I have more than once happened on patients whose wants in this direction had been attended to but a few minutes previously, who were greedily draining the water from ice-bags or other receptacles within reach. It is marvelous to see the rapid improvement in this condition under the influence of rectal saline injections; the tongue moistens, the extreme thirst is allayed, and the patient drops off into a repose

that often changes the clinical aspect from one which is forbidding to a hopeful prognosis.

The further beneficial effect of the salt solution is shown in the improved functioning of the kidneys. Nephritic congestion is of common occurrence in these cases, with a greatly diminished amount of urine, and with the presence of albumin and casts. During several years service in a large receiving hospital in the army service, many hundreds of dysentery patients passed through the wards, and at least 60 per cent. of these showed kidney changes at some time or other ranging from a slight nephritis to a disorganized parenchyma. Under the influence of rectal saline injections the urine becomes decidedly increased in amount and the kidney changes are greatly lessened, as shown by microscopic examination of the centrifuged sediment, which makes this a most advantageous means of dealing with a complicating nephritis at any stage of the disease.

The special symptoms requiring consideration are pain, hemorrhage, and collapse. The first is caused by the almost continuous tormina and tenesmus, the former being associated with involvement of the small intestine and the upper portion of the colon, the latter being most conspicuous with rectal lesions. The pain from tormina is best relieved by the application of an ice-bag to the abdomen, and in order to get the full beneficial effect of this analgesic agent, it must be used correctly and not in the desultory way one observes so often when an ice-bag is prescribed. The bag should be filled with shaved or finely cracked ice, the air should be expelled before the cap is tightened, so the bag will flatten to the surface, it should be covered with only two thicknesses of gauze—not with toweling, as is usually done—and it should be kept constantly in contact with the skin surface at the same point during the period of application, which may be for one hour or for many hours. Its pain-relieving effects will be noticeable in the course of a half-hour, at the end of which time the skin is chilled a dusky red, and the pain from griping will gradually fade. Tenesmus demands the additional use of ice suppositories, and these should be inserted repeatedly. When these measures fail, recourse must be had to a starch and opium enema—30 drops (2 c.c.) of tincture of opium to 2 ounces (60 c.c.) of thin starch—or, better still, to a hypodermatic injection of morphine sulphate, gr. $\frac{1}{4}$ (0.016 gm.), the dose being repeated as necessity requires. Applications of heat to the abdomen will sometimes control the tormina, but frequently such applications increase the pain and the desire to go to stool, and I have learned by experience to place more reliance on cold applied properly, as a pain-relieving measure than on any other means besides opium.

The tendency to hemorrhage is common to all stages of this disease, but actual free bleeding, such as might be due to rupture of the larger vessels, is unusual. The bloody stools that are clinically characteristic of the early stages and throughout the course of the infection, including the chronic stage, are not dependent to any great degree on ulceration, for blood is found in the feces of patients that never show free ulceration at necropsy. They are more generally dependent on the superficial necrosis

of the mucosa and exposure of the underlying network of delicate vessels, rupture occurring either from mechanical causes or from the direct action of the toxin. The hemorrhage that results is of the oozing type, and will seldom be severe enough at any one time to excite alarm; but the constant depletion will greatly weaken the patient and may lead to collapse; so that when the bleeding is continued over an unusual number of days, or when the amount of blood in each stool is excessive, steps should be taken to check it. An ice-bag will prove advantageous, and if this will not suffice, a copious injection of ice-water usually will. A hypodermatic injection of morphine sulphate, gr. $\frac{1}{4}$ (0.016 gm.) will have decided benefit, and this may be reinforced by ergotine if the necessity is extreme and there is reason to suppose an eroded vessel is the source of the bleeding. The various astringents sometimes prescribed have not proved efficacious, and they will further impair an enfeebled digestion and handicap the patient's capacity for recovery.

Collapse must be met with prompt treatment by wrapping the patient in hot blankets and surrounding these with hot-water bottles or hot bricks, and by giving him saline transfusion, 1 to 2 pints (500 to 1000 c.c.), in the upper pectoral and trapezius regions, not disturbing his prone position. If the collapse is due to toxic myocardial weakness, its oncoming will be heralded by a weak pulse and swelling feet, and occasional sips of brandy in hot water or hypodermatic injections of this stimulant and digitalin may avert it. The best prophylactic measure, however, is absolute rest, and where this is insisted on from the onset of the disease, collapse occurs much less frequently. If the condition is attributable to ulcer perforation, recourse must be had to surgical interference, and this must be simple to be effective. General anesthesia should be employed if the patient's condition justifies it, otherwise local anesthesia must be used, and the abdomen entered through a median incision. Intraperitoneal work should be limited to finding and closing the perforation and inserting the drain, without flushing or sponging the cavity.

Feeding.—The selection of a suitable diet is a matter of much concern, and yet, as a rule, this part of the treatment receives comparatively little attention. While the prime object of food selection is to sustain life through the period of illness, and in doing this to control the formation of the fecal food residue to the least possible amount as succeeding days demand an increase in caloric value, much can be accomplished in modifying the outcome of the toxic process.

During the first days, when toxemia is moving to its height and the preliminary purging is being effected, the patient has no appetite for food, and it is useless to force upon him liberal amounts at short set intervals, as they will nauseate him and add to his discomfort, and, too, be poorly digested. Particularly is this true of the patients in whom the onset is sudden and who enter on the disease with a dry tongue and nausea. In the course of a day or two the drain on tissues will cause an assertion of hunger, even in the presence of a pyrexia, and daintily prepared foods will be more palatable, and will be better retained and

digested. During the first week, when the toxic changes are taking place in the bowel and fever is present, foods should be of liquid consistency, and of the proteid variety, for these will be more easily borne, and foods of this class will furnish the greatest amount of nutrition when given in restricted quantities, and will leave a minimum amount of ash. Fresh milk, however, the chief article of a proteid liquid diet usually prescribed, is often not well borne, is not absorbed and assimilated well by dysentery patients, and the undigested curds are a fruitful pabulum for germ growth, so this article should be eliminated from the diet. The selection of the proper food-stuffs can best be set forth by a consideration of the effects some of the organisms of the intestinal flora have on the disease process, and how this effect can be modified by certain kinds of food.

The putrefactive bacteria are the chief factors in the formation and extension of ulcers, as before stated, by acting upon the products of necrosis caused by the specific toxin, and by attacking the raw exposed surfaces. It has been shown that ulceration may occur in both the small and the large intestine, but is more common in the large intestine, the reason being that the putrefactive bacteria are more generally localized in the large bowel. The general incidence of greater frequency of ulceration in the cecum and in the sigmoid and rectum furthermore finds explanation in that these several parts of the gut act as intestinal sinks, and the putrefactive bacteria are more dense in this area. It follows that if the number of these putrefactive bacteria can be restricted and their activity restrained, ulceration will be a much less common sequel to the original toxic process. The putrefactive bacteria are essentially proteolytic, and require protein for their development, and as protein is the principal basis and the sustaining element of the feeding of the earlier days of the disease, in order to limit the number of putrefactive organisms in the intestine, it will be necessary, in addition to flushing the necrotic debris from the intestinal canal, which substance likewise acts as nutriment to the organisms, to give proteid foods so prepared and in such restricted amounts that the protein and the products of protein digestion will be rapidly absorbed and will leave no pabulum for the growth of the bacteria. It is known by experiment that if some easily fermentable carbohydrate is added to protein, it will result in a diminution of putrefaction, so that by giving sugars with the protein foods that are administered, they should materially aid in limiting the growth of the proteolytic colonies. It has also been shown by laboratory experiment that these colonies will not develop in media containing a fermentable carbohydrate in the presence of bacteria capable of forming lactic acid from this carbohydrate, so that it is reasonable to expect that by adding lactic acid bacteria to the protein diet and sugar, the objectionable activity of the proteolytic organisms would be inhibited by the antagonism of the lactic acid bacteria, and ulcer formation would accordingly be decidedly reduced. The lactic acid bacteria can be administered in the form of a ferment used in souring milk, but as there are many different kinds of bacteria which form lactic acid that may be used for

this purpose, it remains to select the kind which is especially adapted to the therapy of this disease.

Of the many kinds of bacteria which form lactic acid, only those organisms are true lactic acid bacteria which form lactic acid without forming putrefactive products from protein foods, and which do not produce gaseous products from the fermentation of sugars, and of these, the two that have been most widely studied are the *Bacillus bulgaricus*, which localizes itself in the small intestine, and which is the culture basis of the bulgarian ferment commonly used as a milk starter, and the *Bacillus acidophilus*, which is normally found in the large intestine, but whose activity is much enfeebled in putrefactive disease of this organ. It follows that in utilizing lactic acid ferments in feeding in this disease the former organism would be more efficient in attempts to control putrefactive processes in the small intestine, and the latter would be more useful when liberated in great number in the midst of the putrefactive bacteria of its normal habitat.

We have, then, a basis for the feeding of the several stages of the disease; efforts should be made during the earlier days to diminish intestinal putrefaction by the administration of restricted amounts of protein foods in conjunction with carbohydrates,—such as beef essence, beef-tea, mutton broth, and clear soups flavored with the expressed juice of fresh vegetables, in alternation with sweetened egg broth, oatmeal water, rice-water, egg-albumin, or lemonade; toward the end of the first week sour milk should be added to the diet to further inhibit the development of putrefactive bacteria at the time when ulcers usually begin to form, the milk being ripened with the two mentioned lactic-acid-forming bacteria, the bulgarian ferment being used in excess when the typhoid symptoms are marked; when the disease persists after the first week, the sour milk-feeding should be continued, with an increase in the acidophilic ferment as toxemic symptoms subside, and vegetable proteids should be added in the form of zwieback, crackers, and the light cereals, with sugars in the form of sweetened chocolate, cocoa, and maple syrup; during succeeding weeks, or when convalescence becomes established, in order to build up the patient's strength, the food energy of this diet should be increased by the cautious addition of small portions of white-fish, lean meats, boiled eggs, and macaroni, the food being well masticated before it is swallowed; and the patient should return to a customary diet only after the stools have been negative for mucus and bacilli for a period of at least one week. Such a course of feeding will aid in preventing the ulcerative sequelæ to the toxic lesions, will promote the earlier healing of these lesions, and, therefore, will be a potent factor in warding off chronicity.

Convalescence.—The first sign of improvement after the toxemic stage is the passage of a feculent stool, and this usually occurs coincidentally with the fall in temperature, and is followed by a decrease in the tormina and tenesmus. In gradual succession the pulse becomes stronger, the tongue moistens, and the urine becomes more abundant. The mucus, however, persists in the stools for some days longer, and

until this remaining evidence of the disease disappears, the patient must remain under treatment. In the very mild cases, particularly in some of the dysenteric attacks in children, the stools will be clear of mucus in from three to five days after the onset of the attack, but the average time in the epidemic disease for this to take place is at the end of the second or the third week; when the mucus ceases to be apparent at the end of this time in those who have suffered severe infections, and in whom the discharge of mucus, pseudomembrane, and necrotic sloughs have been copious during the height of the attack, it signifies that the toxic lesions have gone on to resolution, and that ulceration has been averted. The period of active injury to the bowel-wall effected by the bacilli is limited to the second week at the latest, and in the average serious case a normal repair should not take more than a week or ten days for completion. However, in many of the very severe cases mucus and mucus tinged with blood will keep on for a number of weeks—eight weeks being in general the extreme time limit—and healing is delayed, owing to the great extent of the bared area, particularly in the cases where large gangrenous sloughs of the mucosa and of the submucosa have come away in the discharges, or by the setting up of putrefactive changes. In these cases treatment must be kept up, and the patient must remain bedfast, until the bared surfaces or the ulcers are healed over. When the healing process is protracted to this degree, tonics are indicated to increase tissue metabolism, and the elixir of iron, quinine, and strychnine will be found generally of greatest value, while sometimes nitrohydrochloric acid will be necessary to stimulate impaired intestinal digestion. The saline treatment should be reduced to mild laxative dosage after the first few weeks, and the feeding rules and the colon flushing should be adhered to assiduously until all evidence of the disease has vanished. When mucus has ceased to appear in the stools the disease may be said to be cured; but this does not mean that the patient may with impunity at once resume unrestricted intercourse with the public, for the bacilli may survive in the intestine for some days longer, and while the patient is in no danger from reinfection if the attack was severe, the severe attack conferring immunity for an extended period, he would be a source of danger to the community by being a dysentery carrier. The period that the bacilli may survive in the intestine is a variable one, the farthest time limit being usually ten days to two weeks, although Shiga and Ohno have recovered the bacillus as late as nineteen days after recovery; the average time may be set down as one week, and during this time the patient must be held under observation, and microscopic examinations must be made daily to determine the date of the final disappearance of the organisms. The bacilli will survive in the mucous coat several days after they may be recovered from the discharges, and in order to have a reliable criterion when non-infectiveness will be absolute, it is my plan to take daily scrapings from the rectal mucosa by means of a proctoscope and a blunt spoon, and when these scrapings do not yield material from which the bacillus may be identified, the patient may be considered as no longer harboring the dis-

ease, and may be discharged with safety. It is well to advise indulgence in light exercise for several weeks after discharge, to gradually restore the functioning capacity of weakened viscera.

Chronic Bacillic Dysentery.—When the disease continues over the second month, with more or less frequent thin, alvine movements, mixed with mucus, blood, or pus, or with all three at once, and accompanied with more or less griping and straining, it is considered to be chronic. This means that ulceration has supervened on the original toxic injury, and that putrefactive activity has outstripped the process of repair, or that the toxic process has been too extensive for a depleted system to successfully cope with. The chronicity may be demonstrated in lesser degree by mild and painless diarrhoeic movements persisting after the mitigation of severe primary symptoms, or reappearing after the lapse of several weeks or months subsequent to an apparent cure. This disease does not have a marked tendency to become chronic, but once it reaches this stage it tends to remain so. The condition is liable to be prolonged, and the permanent changes that take place in the bowel, with the constant or recurring dysenteric discharges, become associated with a gradually increasing deterioration of health that finds expression in loss of appetite, abdominal distention, the passage of undigested food, anemia, petechial hemorrhages, exhaustion, and ultimate collapse. Many years may be involved in the steps of this process, and in order to avert these direful results, and before the disease has advanced to the chronic stage, recourse should be had to the following form of treatment, which has proved superior to all others in bringing about a cure in the delayed acute stage, and, therefore, in preventing chronicity.

Vaccine Treatment.—When the patient shows no signs of further improvement after the violent toxemic symptoms subside, it means that the capacity of the body for producing defensive antibodies has become exhausted, and that the local lesions in the intestines are liable to continue if these areas are not reinforced by an increased activity of these healing elements in the tissues. This condition calls for the introduction into the body of an antigen capable of giving rise to the production of antibodies, and this indication is met by the injection of a *vaccine* composed of killed cultures of the bacilli, which, in conjunction with the toxins liberated from them, stimulate the formation of antibodies. This method of treatment has been successfully employed in the treatment of this disease, and its beneficial results have been demonstrated by the reduction of the number of days of invalidism after the toxemic stage, the elimination of chronic cases, the consequent diminution in endemic morbidity, and the marked decrease in mortality. Gillet used this treatment in 261 cases in Indian jails, with a vaccine prepared from Shiga's bacillus, as recommended by Forster, and brought about a reduction in mortality from 5.9 per cent. to 0.9 per cent., and a decrease in the average number of days of treatment from 27.2 days by drugs to 20.8 days by vaccine. In Forster's cases the mortality fell from 6.3 per cent. to 0.9 per cent., among the cases cured being several advanced in chronicity. The vaccine used consisted of a dead emulsion of Shiga's bacillus in normal salt solution to

which 0.5 per cent. of carbolic acid was added, the emulsion being prepared from twenty-four hour agar slope cultures killed by heating to 60° C. in a water-bath for twenty minutes.

Stephen and others have made equally favorable reports on the use of this method, and the results of these various observations leave no doubt as to the efficacy of vaccine therapy in shortening the time of treatment and in modifying the outcome, so that when healing is delayed, or when the severity of symptoms and the character of stools have given reason to expect that such delay will take place, this form of treatment should at once be instituted. The method is obviously not adapted to the acute toxemic stage, for it would be hazardous, to say the least, to increase the amount of toxin in a system already overwhelmed with the poison; and it is likewise not applicable to the late chronic stage, for little could be expected of a vaccine directed against one species of infection when the diseased condition is complicated by a number of other species which take part in the ulcerative process and in toxin elaboration. Its therapeutic value is limited to the days midway between these clinical extremes, and to be thoroughly effective, its application should follow close upon the subsidence of constitutional symptoms. However, the employment of this method is not indicated in every case that passes through the febrile stage with mucus and blood persisting in the stools, for naturally many cases will go on to early and complete recovery without requiring the introduction of an antigen to stimulate healing reaction. Accordingly, some prognostic signs are necessary, which, giving an index of morbidity pointing to the likelihood of chronicity development, and foreshadowing a possible unfavorable outcome, will indicate the necessity for increasing the production of antibodies to fortify the tissue defenses.

In the presence of an epidemic the character of the prevailing type of disease will give some information as to the probable nature of the case development; and the degree of fever will be a symbol of the extent of local toxic involvement, and the amount of work that will later be put on the system to bring about repair; hence, as a rule, it may be said that the higher and more prolonged the fever, the greater is the liability to unhealed lesions, so a vaccine injection would be indicated after the pyrexia subsides. Injection would also unquestionably be indicated on the incidence of such symptoms as great nervous prostration, low delirium, hiccough, inflation of the abdomen, and algidity. In the main, however, the chief reliance must be placed on the character and frequency of the stools as a guide to the employment of the vaccine, and generally the greater the number of stools, the more extensive will be the local toxic process; hence, when stools are passed with less frequency after the first week, and not over six or eight a day, other things being equal, the condition is mild enough to warrant withholding inoculation; so, too, when mucus and blood rapidly lessen in amount, and when small fecal lumps, stained or not with blood, make their appearance during or shortly after the febrile stage. But under conditions where the stools become or remain pulpy, even though blood and mucus are very slight; when the

stools are mostly of a watery consistence and this is not dependent upon drug administration, denoting extensive and high involvement dangerous to recovery if long continued; when hemorrhage is severe, the hemorrhagic breaks in the intestinal tissue serving as footholds for bacteria and making liable the development of ulcers; and when the stools are of a dark-red, albuminous consistence, with a horribly offensive odor, and mixed with gangrenous sloughs, either small or large, the vaccine treatment should be instituted without delay.

When this treatment is used, it is advisable to make an autogenous vaccine wherever possible, for vaccine thus prepared will be more efficacious against the disease process than an extraneous product. The appropriate time for the initial dose is after the severe toxemic symptoms desist,—about the end of the first week,—so ample time is offered for the preparation of the vaccine from the bacilli isolated from the feces of the patient during the early days of the attack. Different methods can be used in its preparation, but killed cultures should be used in each case, for the dose is then under accurate control, the vaccine is easily kept in a condition ready for use, and it has been observed that a small quantity of dead bacteria injected into the subcutaneous tissue has more available antigen than a large number of living bacteria. The method of Forster is simple and reliable, the bacteria being killed by heat, and the emulsified product being antisepticized with carbolic acid to avoid subsequent contamination. The determination of dosage can be made by Wright's method, by the barium sulphate standard, or by direct count with a hemocytometer. Forster standardizes his vaccine by determining the minimum lethal dose for rabbits, and by grading the treatment dosage accordingly, the average amounts administered to patients being 0.1, 0.2, 0.3, and 0.4 c.c., given at intervals of about ten days. The injection is usually made in the subcutaneous tissue of the flank or arm, and is followed by very slight local action at the injection site.

An autogenous vaccine could necessarily not be used with every case in which inoculation would be indicated, for facilities for its preparation would not always be available, and the measure would, therefore, fail in its adaptation to general practice. In order to overcome this hindrance and still retain the full value of the method, there is being produced in a number of laboratories throughout the country a polyvalent vaccine, composed of the dead cultures of the various strains of bacilli, which product has of late become available for general use. Should this combination of strains prove effective in bringing about a reaction in all varieties of infection equal to that of the autogenous vaccine, its employment should supersede all other forms of treatment for the subacute and early chronic stages in the future management of these cases.

Operative Treatment.—The farther the disease advances into the chronic stage, the less likelihood there is for the local lesion to undergo repair, for with the increasing inflammatory changes and connective-tissue formation in the base of the ulcer brought about by the intestinal bacteria, the lesion becomes no longer permeable to the diffusion of those elements necessary to antagonize the bacteria, and their toxin therein

located. These organisms will continue to make inroads into surrounding tissues, and the persisting ulcers will cause a series of recurrences and relapses of dysenteric symptoms that will eventually result in pronounced invalidism. Should, therefore, a thorough course of vaccine inoculation, eliminative measures, bowel flushing, and dieting, fail to effect a cure, the advisability of operative interference should be considered. As there is no way of telling by external examination which portion of the bowel is involved, a laparotomy would be indicated to determine the expediency of excision or of other intervention, as set forth under the treatment of enterocæbic dysentery.

Bacillic Dysentery in Children.—The disease is common among children from infancy to the fourth year, and is particularly prevalent during the summer months in the large cities of America, where it is known under the various names of infantile diarrhoea, cholera infantum, summer diarrhoea, and ileocolitis. It is most common in the congested tenement districts, where sanitary conditions are poor, and it is especially liable to attack bottle-fed infants. It usually appears with sudden onset in children previously healthy, beginning with vomiting, a moderately high febrile movement, coated tongue, distended and tender abdomen, and yellowish or green stools mixed with mucus, generally streaked with blood; or it may come on more insidiously in those suffering from malnutrition and continued digestive disturbances. In the milder forms the diarrhoeic passages may be limited to from four to six a day, but in the severer forms the stools become more numerous,—ten to twenty a day,—assume more decided dysenteric characteristics, and are passed with more griping and tenesmus. The severer forms are accompanied with much restlessness, convulsions, marked prostration, and rapid emaciation, and the child very often succumbs in collapse. This class of dysenteries is generally due to the mannite-fermenting strains of the bacillus, but occasionally the Shiga bacillus is found in the stools.

The treatment which promises the best results is the use of an anti-toxic serum early, injecting the proper dose of a standardized polyvalent serum twice daily. Where this is not obtainable, treatment should be conducted on the eliminative plan. A dose of castor oil, 1 to 2 drams (4 to 8 c.c.) should be given at once to clean out the bowels, and this should be followed by smaller doses of the oil in emulsion twice daily. Saline enteroclysis should be instituted early, the salt solution being injected in quantities of 4 to 16 ounces (120 to 500 c.c.) twice a day. Artificial warmth should be applied constantly to the extremities, and the child's body should be encircled with a flannel binder. If there is much abdominal tenderness and griping, a spice plaster placed beneath the binder for several hours will give relief. Convulsions will require cold applications to the head and minute doses of morphine, and, if prolonged, may necessitate the administration of chloroform. When collapse is threatened 3 to 5 drops (0.195 to 0.32 c.c.) of brandy in a little water should be trickled over the tongue at hourly intervals. If vomiting occurs or curds appear in the stools of the breast-fed infant, a thor-

oughly boiled and strained and slightly sweetened oatmeal water should be substituted for the mother's feeding, and in the case of bottle-fed children, the oatmeal-water should replace at once the customary content of the bottle, the strictest caution being observed in bottle sterilization. I have found this the most satisfactory food for these cases, but in rare instances it has been necessary to find a substitute in albumin-water or barley-water or toast-water. When the symptoms begin to abate and the stools improve, the quantity of food should be increased, but a return to a milk or a more advanced diet should be delayed until the stools are free of mucus. During convalescence the emaciated body will be more quickly restored to normal condition by daily inunctions with oil or an animal fat.

Sequels.—After severe seizures there may be left a trail of evil consequences, including disorders of digestion, nephritis, edema of the lower extremities, swollen liver, paralysis of the legs, hemorrhoids, and prolapsed rectum. Of these, the most common is a digestive disturbance, and this is generally dependent on a permanently altered intestinal wall by cicatrization. Where there has been but a limited necrosis of the mucosa, but great thickening of the bowel-wall, the integrity of the mucosa will be restored in the process of repair, but its glandular structures will be modified by the deep-seated scarring of the submucous, muscular, and peritoneal coats, and the patient will be left with a digestion impaired in greater or lesser degree according to the extent of area involved. The passage of undigested food, obstinate constipation, scybalous stools and diarrhoea are serial manifestations of this condition, and will prove difficult to correct. In their management fruit-juices, predigested foods, gentle laxatives, bitter tonics, soap clysters, abdominal massage, a course of waters, and electrical treatment will be of value, and should the patient's general health or mental condition begin to suffer from his obstinate ailment a long sea-voyage will be the best means for rehabilitation. Where ulceration has been marked in the chronic process, the cicatrices may constrict the intestinal lumen to such a degree as to make it impossible for the patient to ever pass a formed movement; and when the cicatrix completely encircles the gut, the contracting scar may result in complete intestinal stenosis. This is a sequel of comparatively rare occurrence, but is met with at times in those cases who have had severe ulcerative lesions located at the colosigmoid and sigmoidorectal junctions, the peculiar narrowing of the lumen at these portions favoring ulcer formation in the first place, and obstructive scarring later on. When stenosis develops, it demands surgical treatment by a preliminary cecal outlet, a latar laparotomic exploration of the bowels and removal of the strictured section, and a subsequent inguinal closure. The other sequelae call for treatment as usually carried out in these conditions, keeping in mind that the paralysis of the legs is a peripheral neuritis, that the edema of the lower extremities may be due to a functionally weak heart, as well as to the nephritis and the hepatitis, and that the last never eventuates in suppuration, and is usually best remedied by nitrohydrochloric acid and by Bier's hyperemic method.

Prophylaxis.—The two prime elements in the spread of the disease, and in its maintenance in epidemic form are found in the house-fly and in the human bacillus carrier, and the principal preventive efforts must, therefore, be directed to the extermination of the former and to the recognition and cure of the latter. The spread of the disease by an infected water-supply, up to within recent years regarded as of primary importance, must, in the light of present knowledge, be considered accidental or secondary, and the more the epidemiology of the disease is studied, the less credence is given to water as a factor in maintaining dysentery epidemics. When an infectious disease becomes widespread in a locality and the cause is attributable to a polluted water-supply, the epidemic appears in explosive form, which is quite unlike the cumulative manner in which cases appear in epidemics of this disease; and as the bacilli will only survive in water from five to nine days, the maintenance of an epidemic by means of a water-supply could only be possible if the water were frequently reinfected at short intervals, a condition most unlikely under the vigilance generally displayed in safeguarding the drinking supply of towns and cities. It is only in those countries where water-supplies are not safeguarded that any importance can be ascribed to this mode of infection.

The role of the *house-fly* in transmitting the disease has become definitely established, and it has been shown that these insects may carry the disease from the sick to the well in two ways: when flies have access to infected matter, the bacilli adhere to the sticky pads on the flies' feet, and are thus transferred to food, eating utensils, etc., and when flies feed on the excreta of patients, the swallowed bacilli pass through them in the course of an hour and are deposited in an uninjured condition on whatever article the fly may light. It is apparent that when flies have access both to the feces of the sick and the food of the well, they play a momentous part in the spread and continuance of the disease; such circumstance also harmonizes the annual increase and decrease in dysentery cases with the abundance and scarcity of flies. Considering the dangerousness of these insects as a medium of infection, and the universal character of this disease, flies become at once one of man's greatest enemies, and the indifference with which they are sheltered and fed and allowed to breed seems a travesty on the claims of modern sanitary teaching. It is only by arousing the interest of the public generally as to the infectiousness of this disease and the leading part flies have in its transmission, and by bringing the facts properly to the attention of municipal authorities that much can be hoped for in ridding localities of these dangerous insects and in preventing the great annual dysenteric morbidity.

Dysentery carriers are likewise a source of public jeopardy. These carriers may either be mild cases of dysentery—the sporadic variety—that exist as untreated cases of “winter diarrhoea” and “summer complaint,” or they may be cases of severe bacillic infection that pass unrecognized in the early diarrhoeic stage, or that are discharged incompletely cured in the convalescent stage. These carriers are a main source of in-

fection during an epidemic, just as flies are the chief means of conveying the disease, and the prevention and control of outbreaks must, therefore, include a discovery of the infected individuals and caring for their excreta. In this connection too much stress cannot be laid on the necessity of keeping patients under observation and restricting their intercourse with people after the subsidence of a severe attack until the infecting organisms have entirely disappeared from the stools, for negligence in this part of the case management will make the physician directly responsible for future cases that may arise. The finding of the mild cases that act as carriers will be a relatively easy matter under certain conditions where bodies of men are assembled and under the control of recognized authority, as in institutions for the insane and in the military services, but in municipalities there are manifest drawbacks which make it a most difficult task for those responsible for the public health to discover the infecting carriers. As health laws are constituted, these drawbacks can, to a large degree, be remedied by educating the people as to the danger of a persisting looseness of the bowels and getting them to realize fully the significance of the untreated condition. In certain foreign settlements in the tropics, where the disease is more intensified, the inhabitants are alive to the evils of a diarrhoea, however slight, and, as a rule, submit themselves willingly to treatment, and in this way many cases that would otherwise become carriers of the bacillus are cured. This condition has been brought about in these settlements by a diffusion of information as to the infectiousness of dysentery of whatever grade of severity, and the logical necessity for limiting its spread, and it does not appear too utopian to believe that the same condition can be brought about in communities in general, particularly in those that have the advantages of free dispensaries. In this way many of the carriers will be brought to treatment, and on the success that is achieved in finding and curing them will directly depend the usefulness of isolating those ill with the disease. Necessarily, isolation of dysentery patients would be of limited value under conditions where a number of carriers were spreading the disease in the same locality; nevertheless, isolation is the most effective means of controlling the spread of the disease from those actually ill, so this prophylactic measure should be carried out either wholly or in part at the same time that efforts are being made to unearth those responsible for the continuance of the disease.

Much could be accomplished in limiting the spread of the disease by adopting the same stringent quarantine rules that are applied to certain other infectious and preventable diseases. In this respect the health departments of towns and cities have been slow to take advantage of the information conveyed by statistics on this disease and the findings of bacteriological laboratories during the past several years. It would appear that with a disease whose specific infectious cause has been repeatedly demonstrated, that is responsible for terribly destructive summer epidemics, and that is attended with a mortality ranking next to that of pneumonia, when the miscellaneous named diseases showing the bacillus are properly designated under the term dysentery, this disease

should be included in the list of diseases that are required to be reported to boards of health. If restrictive measures are not compulsory, there is often a tendency to laxity in the caretaking of infectious diseases, particularly if these be of a mild type, and the cases of contact infection arising from this laxity, and the premature discharge of apparently cured cases, are matters that should and could be avoided by these compulsory measures.

Prophylaxis by injections of attenuated and killed cultures of the bacillus, either alone or after being modified by autolysis or by admixture with immune serum, has been used extensively by some observers, with apparent good results in diminishing mortality, though with less beneficial effect on the prevalence of the disease. It has not yet been placed on a definite basis for general application.

Briefly stated, prophylaxis against this disease should include the following:

1. Find the dysentery carrier and put him under treatment.
2. Abolish the breeding-places of flies; burn rubbish heaps, put an end to open privies; screen manure and garbage.
3. Secure a pure water-supply; if there is any ground for suspicion in the presence of an epidemic, use boiled water for all purposes.
4. Avoid uncooked vegetables and salads in epidemic areas.
5. Screen houses thoroughly against flies, not only kitchens and dining-rooms; do not afford shelter for flies in any part of the house.
6. Allay dust; the bacilli may be carried to food by this means.
7. Diagnosticate dysentery cases as rapidly as possible, so as to limit the early carrier period.
8. Isolate the patient in a screened room and be sure flies do not have access to his discharges; isolation should be enforced until the bacilli have disappeared from the stools.
9. Disinfect the excreta; mix the stools with sawdust and burn, or treat them with an antiseptic solution.
10. Boil sick-room linen for one-half hour and change bedding frequently; the dysentery bacillus survives in linen soiled with feces for seventeen days.
11. Exercise greater care in feeding infants; in bottle-feeding, unless unusual sanitary facilities exist, pasteurize the milk and protect it from flies.
12. Make dysentery a notifiable disease.

PART II

THE TREATMENT OF DISEASES OF THE CIRCULATORY SYSTEM

DISEASES OF THE HEART. NERVOUS DISORDERS AND FUNCTIONAL DISTURBANCES, AND DISEASES OF THE BLOODVESSELS

By JAMES MACKENZIE, M. D., LL.D.

BEFORE entering upon the consideration of the treatment of affections of the heart, it is necessary to have a clear idea of what we aim at in treating any given individual. This is all the more necessary if we desire to treat the patient on a rational system, for it will be found that the careful analysis in each case of the symptoms, and of the circumstances that have led to the heart failure, vary so much that no two patients present the same conditions, and, therefore, each patient has to be treated with reference to his special requirements. Moreover, there are many phenomena whose nature is obscure, which nevertheless are often the object toward which the treatment is directed, though, in themselves, these phenomena are not the signs of disease nor suitable indications for treatment. We are, therefore, bound to search for some general principle that will guide us to appreciate the peculiarities of each individual, and to estimate the value in treatment of any given symptom whose nature we may not understand.

Before setting forth the indications for recognizing the significance of symptoms and their relation to heart failure and to treatment, it is necessary to point out that many prevalent ideas as to the need for treatment have to be materially modified. Until late years so very little was known of the mechanism by which many cardiac phenomena were produced, and their bearing upon the heart's efficiency, that the conception of heart failure and the manner of its production have been imperfectly realized. As practising physicians, we constantly meet patients being subjected to strenuous and irksome treatment because of the presence of some symptom, which, being considered abnormal,

became, in consequence a suitable object toward which treatment should be directed, but which in reality may have indicated no harm in the present, nor foreboded any danger in the future, while, in some instances, the supposed abnormality may actually have been an indication of a sound and healthy heart.

From such considerations as these it has been necessary, in ascertaining the significance of many heart symptoms, to watch individuals for many years, in order to find out the bearing the abnormal symptoms (whether their mechanism be understood or not) may have upon the patient's future, and what indications they may give for treatment. Hence, the determination of the value of symptoms plays a very important part in seeking for some definite principle on which to base a line of treatment. In order to give a clear idea of what the principle may be, it is necessary to understand what heart failure is, seeing that the necessity for treatment is in many cases due to the fact that the heart cannot maintain an efficient circulation. Before dealing with treatment I, therefore, propound the following conception of heart failure, which I have found universally applicable, and which is more or less consistent with the experience of every physician who has given thought to the matter.

HEART FAILURE

The object of the circulation is the supply to the tissues of a material capable of nourishing them, and the removal of such waste-products as can enter the circulation. The heart and bloodvessels are constructed specially to favor this object. The heart muscle supplies the force which maintains the circulation, and the bloodvessels are so constructed as to facilitate the work of the heart. Any disturbance in that adjustment must at once entail more work upon the heart muscle, inasmuch as a departure from the normal means the embarrassment of the heart in its work. From this consideration it will be seen that the essential factor in maintaining the circulation is the heart muscle, and any disease process usually affects the circulation only by embarrassing the work of the heart muscle.

The force inherent in the heart muscle may be considered, for practical purposes, to be composed of two parts, viz., a part which is employed to maintain an efficient circulation when the body is at rest, and which, therefore, may be called the "rest force." The rest force is the minimal which the heart can exert to maintain the circulation at a level consistent with life—an impairment of it leads inevitably to a fatal issue. The second part of the heart's force is that which is called upon when the body makes some effort. While the body is at rest this part is not exercised, but it is by the presence of this force that we are able to undertake with ease all forms of effort. Inasmuch as this part of the heart's force is only used when exertion is made, it may be called the "work force" of the heart.

The reason of this division of the heart's power into the "rest force" and the "work force" is that it enables us to understand better what

heart failure is. When we reflect that any disturbance of the circulatory mechanism implies an embarrassment of the heart muscle in its work, we shall realize that heart failure means an inability of the heart muscle to overcome successfully the obstacles opposing its work. The disturbances of the circulatory mechanism may be of a very varied character, and may arise from a great variety of causes, and it is from this standpoint that the bearing of all seeming abnormalities upon treatment should be considered. Thus, valvular defects should be studied, not as specific affections to be treated in themselves, but as sources of embarrassment of the heart muscle in its work, or as indications of disease processes, which may have extended to and affected the walls of the heart or blood-vessels, as the aorta and coronary arteries. In like manner, before treating irregular action of the heart, it should be considered whether such irregularity embarrasses the heart in its work, as well as from the standpoint of the condition causing the irregularity. Arterial degeneration and high blood-pressure, while requiring full consideration, should also be viewed as agents tending to upset the normal adjustment of the factors that carry on the circulation. The possibility of inherent defects in the muscle wall itself should be considered in all cases, as they have a most important bearing on the heart's efficiency. Overwork, bodily or mental, too little time given for rest and restoration of the heart's strength, worry, sleeplessness, the reaction of the nervous system and other organs upon the heart, should all be taken into account when the factors producing heart failure are being considered.

Heart failure invariably starts in the first instance by an exhaustion of the work force. The exhaustion is slight at first, and by the persistence of the factors inducing it, and its indications being ignored, it proceeds apace, until after a period, long or short, the rest force is encroached upon, and with the exhaustion of the rest force a point of danger to the life of the individual is reached.

The first sign of heart failure is invariably a subjective one, although it may for a time be ignored. The patient's attention is drawn first to his condition by some feeling of distress in the performance of some act he was wont to do without discomfort. It is the limitation of the field of cardiac response which is the first and dominant feature in all forms of heart failure, and it is by the due appreciation of the patient's sensations that the physician obtains the most reliable information about the condition of the heart's strength. The standard by which the heart's strength is measured is peculiar to the individual. Each one knows the amount of effort he can put forth without distress, and this is the only practical standard. The kind of distress called forth varies—breathlessness, palpitation, sense of exhaustion or suffocation, pain, are the more common sensations experienced.

By the time objective signs of heart failure have arisen, as dropsy, labored breathing when at rest or after slight exertion, increased rate, dilatation, the heart failure has proceeded a long way. When such objective signs persist when the body is at rest, then the work force is practically spent and the rest force is being exhausted.

Difficulty in Estimating the Effects of Remedies.—While the foregoing account deals with actual failure of the heart, it is necessary to recognize the fact that the majority of "heart" patients whom the physician has to treat suffer only to a slight extent, if at all, from heart failure. Disagreeable sensations may arise, due to, or associated with, some circulatory condition, as palpitation, irregular action, feelings of weakness and faintness, or nervous sensations of various kinds. There may be found a certain limitation of the field of cardiac response, some more or less distinct cardiac abnormality, as a murmur, irregular action, or an increase in size, or no abnormality can be detected, but, in any case, the heart is considered the organ at fault, and toward its restoration active means are taken. The remedial measures may result in the restoration of the patient to a more healthy condition with the disappearance of disagreeable sensations. If care be not taken to recognize the nature of the complaint, and the part played by the various agencies employed which may be successful in these cases, some particular agent may come to be reckoned as valuable in the treatment of all sorts of heart affections.

It is therefore necessary, before entering more particularly on the consideration of the agents usefully employed in treating cardiac conditions, to glance briefly at certain factors which influence patients and physicians in the selection of cardiac remedies.

The most potent of these factors is suggestion, which is so subtle in its action that neither patient nor physician realize its activity. I have just referred to the fact that in many cases the symptoms of the supposed heart affection are dependent on the state of the patient's nervous system, and the treatment, by improving the health of the patient, dispels these symptoms. In the course of treatment the patient's mode of living may be materially modified, as in restricting his diet or indulgences, or the amount of effort, or in seeking change of scene, etc. To these changes may be added some drug or exercise or bath, and the resultant improvement is attributed to the special means. In this way numerous special agents have obtained a reputation as being efficacious in treatment. But in addition to this doubtful source of obtaining remedial measures another occurs, due to the nervous condition of the patient. There are many people who imagine they have a cardiac affection, and are in consequence peculiarly apprehensive, and any circumstances which remove that apprehension will at once relieve the patient, but, some remedy being applied at the same time, the patient fancies that the relief has been obtained by the specific action of the agent on the cardiac trouble. To discriminate the real from the seeming is a matter of extreme difficulty, particularly when there is a certain degree of heart failure due to some organic lesion of the heart. It has been said, with a great deal of truth, that the cardiopath tends to become a neuropath. And it is this fact which, not being recognized, misleads the profession in regard to the value of remedies. As an illustration, I may quote the following experience. I have seen at intervals an intelligent man, who suffered from advanced cardiosclerosis and frequent attacks of angina pectoris. Relief from these attacks was always ob-

tained by $\frac{1}{100}$ grain of nitroglycerine. He also had at times attacks of dyspnoea which were rather distressing. He told me that relief from the dyspnoea was always obtained by the use of the nitroglycerine, although it took half an hour to act. I had ascertained that his attacks of dyspnoea would sometimes stop if he became deeply interested or if he talked. I reasoned with the patient that I was in doubt whether the nitroglycerine could give him relief, stating that the action of the drug was very speedy, and I would have expected relief in a few minutes after taking it. However, he was so confident of its good effect that he promised to keep a diary for me of the attacks of dyspnoea. This diary I have before me now, and I need only say that it recited the occurrence of two attacks, which were duly relieved half an hour after taking the nitroglycerine. Then a third attack was described, for which only a peppermint lozenge was taken and in a quarter of an hour complete relief was obtained. When next I saw the patient and talked over the experience, he remarked that he had a great faith in the efficacy of peppermint. It is scarcely necessary to point out that the infinitesimal quantity of peppermint could only have acted when accompanied by the faith in its activity.

This effect upon the patient of measures plus faith is well recognized though not sufficiently discounted. Nay, more; it can be affirmed that the medical profession too often shares the same unconscious deception. I have marvelled that men, trained in the exact sciences, and who can reason logically, appear to lose all sense of proportion and reality when they come to deal with remedies that are supposed to affect the organism. The readiness with which statements are accepted, and the entire absence of the critical spirit, have introduced so many so-called cardiac remedies that it is possible for one individual to determine the efficacy of only a small number. When the evidence on which many of the remedies are recommended is examined, it is found that it is impossible to put the evidence to a test. If one inquires into the proof, it will be found that the proof depends on inferences drawn from the improvement in the condition of certain patients when the remedy has been applied.

The careful reader can seldom tell the exact nature of the complaints of such patients, and it will often be found that, at the same time, other agencies were employed, or that the individual was susceptible to suggestion. If, for instance, we inquire into the administration of such a drug as digitalis, whose potency no one would deny, and whose action on the heart and bloodvessels can be accurately measured by various mechanical means, we find the drug recommended in doses so small that by these means we can get no evidence of its action. The digitalis is recommended in doses of 2 to 5 minims of the tincture, and its result is said to be detected by some in a few minutes after the dose, and by others after a few hours. When it is pointed out that neither the rate nor the rhythm nor the size of the heart nor the blood-pressure is affected by such doses, the answer is that the finger can detect some change in the character of the pulse or of the artery. This being purely personal evidence cannot be contested, for the observer claims a delicacy in perception denied to

ordinary mortals. In like manner strychnine has of late years come to receive such an amount of commendation that the belief in its efficacy amounts almost to a superstition. Yet, given in medicinal doses, it is absolutely without detectable effect upon the heart or bloodvessels, experimentally or in the human subject. No great harm might accrue from these beliefs were it not that it leads to the perpetuation of methods of treatment which are vain and valueless. Positive harm does actually occur, for, in cases of serious heart failure, the belief in these ineffective remedies leads to their employment and to the neglect of more efficient measures, so that the patient's life may be put in jeopardy, if not sometimes sacrificed. I have repeatedly been called to see patients *in extremis* from the heart failure following after fibrillation of the auricle (nodal rhythm) when for long periods small doses of digitalis or frequent hypodermic injections of strychnine were given. The immediate prescription of effective doses of digitalis has in many cases improved the patients' condition, so that in a few days they have been out of danger. I shall again revert to this matter in speaking on the value of drugs.

This aspect of the subject is of further importance, in so far as it concerns the advances to be made in the treatment of heart affections. There are many forms of heart trouble for which our present methods are of no avail, but to a great extent the profession is prevented from realizing its deficiency because of the faith in the ineffective procedures, so that, in place of realizing our limitations, and striving to perfect our methods, writers are too often content to recapitulate an array of methods and remedies which the practitioner, in attempting to employ, finds to be absolutely useless. If the profession was more impressed by their impotence, there would be more hope for advance in treatment.

Principles of Treatment.—Bearing in mind the view that heart failure begins by an exhaustion of work force, and is perceived only when exertion is made to the full amount of which the heart is capable, the first duty in treatment is to ascertain what circumstances have induced the heart failure. To this end an inquiry is made into the patient's condition to find out when first he became conscious of the limitations of his cardiac field of response. Then a searching examination into the circumstances preceding that period, as to the question of overstrain, worry, sleeplessness, possibility of infection. The inquiry next proceeds to the examination of the circulatory system, and any defect there must be considered from the point of view whether its presence embarrasses the heart in its work, as a valve defect, degenerated heart muscle, arterial degeneration, or whether its presence indicates some active change going on in the heart, and the failure has been due to a gradual weakening of the heart from this cause. If the physician is careful to bear in mind that an abnormal sign is not necessarily an evidence in itself of disease, and that it is not the sign which has to be treated, but that the essential aim in the treatment of heart failure is the restoration of the work force of the heart muscle, then he will have a sure guide in applying treatment to the most diverse conditions, even when the symptoms are not fully understood. Before proceeding to

treat the patient, then, we try to appreciate the value of his symptoms, subjective as well as objective. When we do find some abnormality on physical examination, its bearing upon the subjective sensations has to be considered on the lines already laid down, and all attendant circumstances that may have contributed to the heart failure must be taken into consideration.

When we detect some actual cardiac defect, and we do recognize that the heart failure is undoubtedly brought about by its presence, then, provided that we cannot remove the actual lesion, the object of treatment is to restore the exhausted muscle, and place the patient in such a position that he can lead a life useful and free from discomfort, though hampered by an obstacle to the heart's full efficiency. We should keep steadily before our view the fact that the heart is impaired, and it is vain to attempt to restore the irremediable. This suggestion may seem so self-evident as scarcely to need remarking, still less to be emphasized, but, from practical observation, I feel the necessity of insisting upon it, for patients with an incurable cardiac defect are continually being subjected to treatment whenever they consult a physician, and they may be found going to health resorts year after year under the impression that in some way or other the defect needs treatment. If the patient had an ankylosed joint or a wooden leg, it would be recognized that baths or drugs can do little for him, but the thickened edges of a mitral valve are supposed in some way to need constant treatment. The object of treatment should not be to try to remove what cannot be cured, but to make the best of what power the heart still possesses. In the nature of things, it may be that only a partial restoration of the heart can be looked for, and when we recognize that the fullest amount possible is gained, judicious advice as to the future life of the patient may cause him to lead a life at a lower level, it is true, but still useful and interesting, and his years may be prolonged to the allotted span. Many individuals, with a work force limited on account of inherent defects in the heart, may never suffer from heart failure of any serious moment, and where the lesion is not a progressive one, they may suffer little inconvenience, provided that their limitations be appreciated by themselves and their medical advisers. It is in these cases that the advice of a wise physician is of great service. The knowledge of how much an individual may do, the permission to do as much as his work force will allow him, without inducing exhaustion, can only be acquired by the full and careful consideration of all the individual symptoms. Much inconvenience may be caused to the patient by taking too grave a view of his cardiac defect, and so limiting him far too strictly, and hampering him in his life work, and oppressing him needlessly with the supposed gravity of his condition. On the other hand, the pursuits of a man whose heart is embarrassed by a grave defect may imperceptibly call too frequently on the full extent of the work force of the heart, and, the period of rest being insufficient, exhaustion of the work force gradually proceeds, until heart failure of a more or less serious degree is induced. The work of man has attained a rough and ready standard in most trades and pro-

fessions, and the amount is fairly commensurate with the work force of the average healthy man. The man with a cardiac defect is handicapped in the race, and, if the handicap is too heavy, his endeavor to keep his place is made at the expense of his heart's strength. The inevitable result is exhaustion of the work force, which advances slowly but surely.

I put the matter in this way, and dwell upon it with some insistence, because, if the physician guides the sufferer in his work, he may give life and hope to many a stricken fellow. Thus in the early years, after some cardiac lesion following rheumatic fever or other infective complaint, the choice of a profession which will never entail severe bodily exertion may enable the lamed individual to live a useful and contented life. In more advanced years the recognition of the early stages of some progressive lesion, as *cardiosclerosis*, may enable the physician to advise the patient to avoid certain deleterious influences in his work or mode of life, measures which may diminish the progressive exhaustion of his work force, and enable him to pursue a useful and comfortable existence for an indefinite number of years. So in the many other phases in which a heart trouble may mar a patient's life, as, for instance, the question of pregnancy and its relation to heart trouble—a subject, indeed, of the first importance, but unfortunately too little considered.

It may reasonably be asked what are the indications which should guide the physician in advising a restricted life. No answer can be given of definiteness sufficient to be applicable to every case. It is in this respect that a wise judgment needs to be exercised. Many symptoms are so obscure in their origin, there is such a tendency in the human mind to see evil in what is not understood, that a very urgent caution has to be given not to attach too grave a significance to any sign or symptom. The more common forms of these I deal with later (see *Symptoms as an Indication for Treatment*); here I would lay down the general proposition, let no abnormal sign of itself be the reason for giving a prognosis or for subjecting the patient to treatment. A careful search should be made for accompanying symptoms, and a careful inquiry into the condition of the work force and the reason for any exhaustion, and on the results of such an examination the final decision should be based.

When the heart lesion is not progressive, the best line of advice is that the patient should follow his trade or profession and indulge in such exercise as he can in comfort, avoiding all forms of effort that induce distress. When effort that may involve strain has to be undertaken, a period of rest should follow, sufficient to permit full recuperation. By this line of conduct the heart itself will benefit by the judicious exercise of its functions, and the patient will be freed from the restrictions of an invalid life.

Remedial Measures.—When the heart failure persists in spite of restriction of effort and the removal of injurious influences, further measures must be adopted. The periods of rest must be increased, and remedies that may strengthen the heart administered. The administration of drugs of the *digitalis* group may be called for, the chief indica-

tions being dilatation and increased rate. In acute cases with fever digitalis is ineffective, and the treatment should be directed to the cause of the fever, and to giving the heart as little to do as possible. In like manner, when there is evidently a progressive exhaustion of the heart's strength, the amount of effort must be reduced to the lowest possible. When the heart failure is extreme, and the rest force is being exhausted, as evidenced by the persistence of symptoms of heart failure, when the patient is laid in bed (dropsy, difficulty in breathing, etc.), then absolute rest is indicated, the pushing of such drugs as digitalis until their physiological effect is produced, and the treatment of special symptoms by appropriate remedies. (See Symptoms as Indications for Treatment.) Sleep must be obtained. The food must be restricted, as described under Diet, the bowels must be carefully attended to, and aperients or enemata given if necessary. If there are much dropsy and congestion of the liver, a smart mercurial purge may be of use. If, however, the movement of the bowels induces extreme exhaustion, they had better be left alone for the time being.

Rest.—It may seem unnecessary to dwell upon such a well-recognized agent in cardiac treatment as rest, were it not for the fact that its effects are seldom appreciated fully. In a great many systems of treatment rest is only one of the factors employed, and the resultant benefit is rarely attributed to the rest, but to some other agent that has been employed at the same time, as baths, movements, drugs, massage, change of residence. Were the value of simple rest to body and mind sufficiently appreciated, we should hear less of the value of cures by special methods.

In the closer study of the heart, as revealed by graphic records, we cannot but be struck by the great difference in the vigor with which the heart's functions are performed, according to the amount of rest that preceded the exercise of them. It is a well-established fact that, after a contraction of the heart, the power of contracting is for a brief period abolished. When the power begins to return, the resultant contraction is at first extremely feeble, but with increased delay there comes an increase in the strength of the contraction. While this is true in regard to healthy hearts as well as diseased, it is much more readily demonstrated in the human heart when there is a certain amount of exhaustion. In the form of irregular heart action, which shows the *pulsus alternans*, every second beat varies in size, a small beat and a large beat alternating, although the rhythm is perfectly regular. It seems that there is a minute difference in the duration of the beats, the smaller beat lasting a shorter time, so that the following diastolic period is slightly lengthened, and in consequence the following contraction is more vigorous and lasts longer. Lasting longer, it encroaches upon the following diastolic period, with the result that the subsequent contraction is smaller and shorter in duration. This explanation shows that power is gained by a period of rest that is scarcely appreciable by ordinary methods of measurement.

In many cases where the heart is continuously irregular it will be found that the size of the beats has a definite relation to the preceding

period of rest. The restorative qualities of rest can also be demonstrated in the case of the rate of passage of the stimulus from auricle to ventricle. In many cases, where the function of conduction is depressed, the slightest slowing of the heart's rate shortens the interval between the auricular and ventricular systoles.

It is probable that the extraordinary beneficial action of drugs of the digitalis group is in some measure due to the fact that they induce a marked slowing of the heart's action, so that more rest is obtained for the exhausted muscle.

When a heart is exercised to the exhaustion of its work force, it is absolutely necessary that a period of rest should follow of sufficient length to permit the full restoration of the work force. If the rest is not sufficient, the exhaustion gradually becomes more readily induced, until definite signs of heart failure are perceived. Recognizing thus the potency of rest in maintaining the working power of the heart, we can readily appreciate its beneficial effect in treating exhaustion. We have, therefore, to consider how best the necessary rest can be attained. In many cases, by diminishing the amount of the day's labor, a longer period of rest may be obtained which is sufficient for the purpose of restoring the exhausted heart. Other means for obtaining rest for the heart can be employed in protecting the heart from undue excitement. Bodily effort is not the only cause of exhaustion; in many people an irritable nervous mechanism playing upon the heart induces a reaction that is peculiarly exhausting. In many sensitive nervous people the readiness with which the heart responds to stimulation constitutes the real source of trouble, and in time leads to very marked exhaustion, especially if the heart is affected by some organic lesion. In these cases more good can be done by treating the nervous element in the case, by finding out and removing the cause of the excitability, or by removing the patient to more congenial surroundings, as to an environment that will interest without exciting or by dulling the nervous system by such drugs as the bromides.

Worry, business or domestic, plays an important part in depressing the heart's functions, and, when it is not possible to free the patient from it altogether, steps should be taken to mitigate it as far as possible. Other forms of mental disquiet should also be inquired into and treated. Sleeplessness, disturbed sleep, and unpleasant dreams do much to hinder a patient's recovery and aggravate the heart failure. It may be said with truth that no heart can regain its full strength if sufficient sleep is not obtained. The various remedies for obtaining sleep will be considered later.

These suggestions have reference to rest, as applicable to the milder forms of heart failure. Rest is of far greater value in cases of extreme heart failure, where the work force is practically exhausted and the rest force is encroached upon, *i. e.*, the exhaustion has become so great that the symptoms do not abate when the patient is laid in bed. While this condition demands the exhibition of other remedies than that of rest, yet rest itself is of the utmost value. In these extreme cases it is not

always easy to hit upon the position the body should occupy that is most beneficial. As a rule, the patient's sensations are a very good guide. It may be that lying in bed causes such distress that the patient is not at ease unless he assumes some position which he finds removes the discomfort, as in sitting in a chair, leaning forward on a support. Such individuals should be permitted to assume the positions in which they find the most comfort, or, at least, less discomfort, as it favors the circulation in regions which induce the distress, as in the lungs or brain, though it may militate against the circulation in other regions, as in the legs. When dropsy tends to increase in such cases, careful change in position, raising the legs as high as possible, deft bandaging and massage, may do much to diminish the swelling, other treatment being at the same time directed to the dropsy and heart condition. When the failure is not so extreme, and particularly if there is dropsy, complete rest in bed is of the greatest service, and many cases recover without other means. If necessary, the shoulders should be raised by pillows or a bed-rest to such a height as may prevent attacks of dyspnoea coming on during sleep.

Diet.—A pressing consideration that arises, more particularly in the severer cases of heart failure, is the question of diet. The subject is forced upon every physician, and many have elaborated special systems. Many dietaries are based on theoretical considerations, or on the physician's own personal experience. When it is borne in mind that we still know very little about the factors concerned in metabolism, and that, notwithstanding dogmatic assertions, every given dietary must be based upon a very imperfect knowledge of the intricate digestive processes, we should be chary of basing our practice on any special dietary. Moreover, we must be still more chary of drawing conclusions from our own personal experience. Repeatedly, patients are told to avoid this article of diet or that, and the only ground for the objection is that the article disagrees with the physician. It is very curious how many people imagine their own digestive organs to be the standard of perfection.

In prescribing a diet, we must be guided by common sense and consciousness of our own limitations. In forbidding articles of food we may be producing effects other than those we imagine. Thus, when physicians fancy they can stop senile changes by eliminating chalk or common salt from the food of their patient, they must seriously consider not only the very doubtful result of such deprivation, but the effect the deprivations may have on the patient's mind. Thus, to carry out the instructions to have a salt-free diet, the food for the whole family may have to be rendered unpalatable, for many dishes cooked without salt lose their savor. Moreover, the patient is made conscious at every meal of his heart trouble, and if he travels he may have to take food in which salt is an ingredient, and he then becomes morbidly anxious as to the result. Of course, it is foolish for the patient to have taken his instructions so literally, but the physician can seldom imagine the effect of his remarks on a mind made highly nervous because of some heart trouble. These remarks are made because I have repeatedly seen pa-

tients and their friends made absolutely miserable on account of uncalled-for restrictions.

In cases of heart failure, a great deal of harm can be done by injudicious feeding. It must be kept in mind that in cases of extreme heart failure and in febrile cases the digestive functions are themselves greatly weakened, and that to pour food into a weakened stomach is not only to add to the discomfort of the patient, but may produce flatulent distention of the stomach and bowels, which, pressing on the diaphragm, embarrasses the heart and respiration. The manifest weakness of the patient is often taken as an indication for more food to restore the strength, and satisfaction is felt so long as fluid is seen to disappear into the patient's interior. It is very curious how very prevalent the custom is, when the stomach is weak, to give it more work to do. The food is prepared in such a manner that the assistance of the mouth is dispensed with, and more work is thrown upon the stomach. Bread and milk, a favorite food, is prepared so that no mastication is needed, and the stomach is burdened with the duty of getting rid of the load. The great importance of oral digestion is not sufficiently appreciated. Not only does the process of mastication in several subtle ways stimulate the digestive glands of other organs, but the juices from the mouth are so mixed with the food that they not only assist digestion, but prevent the flatulence which is so often such a troublesome feature in the weakened digestion which accompanies heart failure.

In cases of extreme heart failure, with dropsy, the food should be very limited in quantity—as a rule, small quantities of milk, given at frequent intervals—in extreme cases not more than one pint a day. The patient should be encouraged to take a small portion of biscuit, or a dainty sandwich with fresh potted meat, chewed very thoroughly. The mouthfuls should be small, especially when there is labored breathing. In febrile cases, or when the mouth tends to become dirty, it should be washed and sponged out, and immediately afterward a small solid piece of food should be given to chew.

With less severe cases, the food should be more varied, but it should never be forced on the patient. The quantity he can chew is often a very good guide, because, if he cannot be tempted to chew much, it is manifest that his digestive organs are at fault, and it is a very bad practice in such cases to pour in beef-tea and other easily eliminated fluids. The guiding principle should be food, tempting, needing mastication, with little fluid, and that chiefly milk, given small in quantity and at fairly frequent intervals—the intervals depending on the quantity he is able to take. The kind of food should be that which the patient likes, so long as it does not disagree with him. Food which causes discomfort or distaste should not be forced. The doctor must be on his guard not to prescribe a dietary suitable to himself, but must bear in mind that what disagrees with him may agree with his patient. In selecting a dietary, the resources of an intelligent housewife will often be found to be of much service.

Individuals with heart trouble, but able to get about, should lead

a life of abstemiousness, avoiding all excesses. The meals should be small in quantity, and of such frequency that all faintness is avoided. It often happens that they become faint in the night or early in the morning, as they have not broken their fast since the evening meal. A dry biscuit and a small cup of milk at bedtime or in the early morning will often prevent the occurrence of disagreeable sensations.

Exercises.—It may be laid down as a general law that every organ in the body is benefited by the exercise of its functions. The benefit does not accrue merely by the exercise at a low level, but by periods of increased effort followed by periods of comparative rest. This is well seen in all muscular organs, where, in the nature of things, muscular effort is intermittent. While most muscular organs obtain periods of absolute rest, no such possibility can pertain to the heart's action—it has to be content with periods of comparative rest. Nevertheless, it follows the law that periods of increased work are beneficial to its well-being. The beneficial effect arises, not only from the exercise of its inherent functions, but also from the fact that the more energetic action causes the whole organ to be flushed by a large supply of blood. There is no agent so potent as exercise for rapidly and thoroughly producing a reaction on the heart. This reaction, when carried to excess, may do harm, but, when judiciously employed, it is an excellent and extremely valuable help in treatment.

Considering that heart failure is induced by a disproportionate relation between the work the heart has to do and the period of rest, and that, therefore, a principle in treatment is to give the heart more rest, it seems, at first sight paradoxical that exercise should be an agent in restoring the heart's strength. If, however, we bear in mind that there are limits which may be transgressed, and that there are conditions when it is not wise to exercise, just as there are conditions which benefit by exercise, we may be able to determine which cases need or do not need this method of treatment. The conditions which contraindicate exercise in treatment are acute and progressive affections of the heart, and when heart failure is so extreme that the rest force is being exhausted. All other conditions benefit by exercise judiciously employed, and no abnormal sign should be taken to forbid exercise unless it is accompanied by progressive exhaustion.

The manner of using this really potent therapeutical agent depends on the nature of the case. It is obvious that the same amount and the same form is not applicable to all cases, nor is there any necessity for the many elaborate methods which have been evolved, as none of them possesses any specific virtue, notwithstanding the assurance of their inventors. There is no harm likely to arise from their use, but the belief that only certain methods are efficacious tends to limit the employment of exercises as a general method of treatment.

When patients go out, their exercise should be in the open air, even though it is limited to certain gymnastic movements. If they can walk quietly, that in itself may be sufficient, and, if the walk be taken systematically, a great amount of reserve force may gradually be ac-

quired. As a rule, people benefit more by exercise when it has an object beyond medical needs, hence the added interest of a game, or the study of objects of interest, as architecture, botany, etc., will add materially to the efficiency of the exercise. The particular taste of each patient has, therefore, to be studied, and the form of exercise prescribed that is likely to combine therapeutic with personal interest.

When patients are confined to the house or to bed, moderate exercise of the muscles proves useful, so long as it does not embarrass the heart. To this end the various movements and gymnastics may be of use.

In the great majority of cases of serious heart failure, even after recovery has set in, the judicious employment of muscular exertion is beneficial. It may be a matter of difficulty to determine whether more serious cases are fit for exertion, and, if so, to what extent. There is a very simple rule I have been accustomed to follow for years with the greatest satisfaction—let the patient employ what form of muscular exercise he can best do without cardiac discomfort. By discomfort, I mean when the various signs which are given by the heart when its reserve force is exhausted—breathlessness, palpitation, sense of exhaustion, pain. No fixed amount of exercise should be made, for an amount of effort that exhausts a patient one day may be undertaken with ease the following day. If the rule be followed that the amount of effort be determined by the ease with which it is accomplished, no danger will arise from overexertion, while opportunity will be afforded for the heart to regain its full measure of strength. Discomfort may be experienced first in the muscles exercised when some particular group of muscles is more particularly employed, as certain thigh muscles in climbing, and certain arm muscles in playing golf—indications more of want of training of these muscles than of heart exhaustion. This form of discomfort need not prevent further exercise.

Massage.—To patients who are perforce confined to bed, but for whom absolute rest is not imperative, massage may prove helpful. It is particularly useful for patients who may be expected to regain sufficient strength to be able to resume an active life, as in the convalescence from febrile affections after the more urgent symptoms have disappeared, in all forms of extreme heart failure, in patients with angina pectoris when the heart exhaustion has for the time gone so far as to necessitate complete rest. In dropsical cases, the gentle but firm massage of the legs may prevent the dropsy reaching an extreme degree, and in some cases it accelerates its disappearance.

It is not necessary that a skilled person should apply the massage, for that would exclude its use among the majority of sufferers; the gentle but firm pressure intermittently applied to the muscles, systematically undertaken, is usually quite sufficient.

Baths and Spa Treatment.—A very powerful influence can be exercised on the circulation by immersion of the body in water. This may act in several ways, mainly depending on the temperature. Great therapeutic efficacy is claimed for certain waters, but it is very doubtful if any ingredients in these waters have any effect upon the heart beyond

their effect in stimulating the skin. My personal experience has been limited to observing the results in patients who have returned from the various spas, and I have seen nothing of their good effects to lead me to place hydrotherapy very high as a means of treating affections of the heart. No doubt some good results from the whole régime pursued at the different spas, including baths. I have seen some very good results from patients who have bathed in the open sea. When I have had patients who were fond of sea-bathing, I have allowed them to indulge in it, warning them to refrain if it brought on any sense of discomfort. In many cases the result has been extremely satisfactory, the whole system of the patients has been braced up, and they have returned from their holiday greatly benefited.

Sea-bathing has, after all, only a limited sphere of usefulness, and many patients obtain great benefits from visiting spas, and the supporters of each spa claim for its waters some special virtue. In order to assess the value of the claims, it is well to bear in mind by what process benefit is obtained at the various spas. The vast majority of patients go there as much for a holiday as for treatment, and when a patient is sent there, it is often because the individual, in addition to his complaint, has been busy with his affairs, and his heart complaint has been thereby aggravated; or a patient is convalescent, and a change of air, scene, and mode of life is often found beneficial. As the various spas cater for the more enjoyable side of existence, they attract large numbers of invalids, who naturally desire the reputed benefits of the water, and drink them enthusiastically, or, if they cannot drink them, at the least, bathe in them. It will thus be seen that the benefits gained at such places arise from a variety of causes, and it is but in accordance with human nature to attribute what benefit has accrued to the factors that most appeal to the imagination, such as gaseous waters from the bowels of the earth. Every practitioner of experience will agree with me that a large proportion of heart cases return from their holiday greatly improved, and this improvement is not limited to those who went to some particular spa, but includes all sorts of places, spas, seaside and mountain resorts, sailing on sea and lake. It is evident that results thus obtained cannot be due to the peculiar constituents of the waters of any single place.

Venesection.—In a number of cases the abstraction of blood from the patient affords very considerable relief. Unfortunately, the relief is only temporary and in extreme cases only delays the end. Although I have practised venesection in a great variety of cases, I cannot say I have seen it do any lasting good. The indications for its use that have been my guide have been distress in breathing, on account of great distention of the right heart. In cases of mitral disease this has generally been recognized by the increase of the heart's dulness to the right. In cases of high blood-pressure (cardiosclerosis) it has sometimes been difficult to detect much enlargement of the right heart, and the tense filling of the veins of the arm have been the indication. I have always bled at the usual place, at the bend of the elbow, and abstracted from twenty to

thirty ounces of blood. The immediate relief given to the patient is often very striking. In cases where there are repeated attacks of heart failure, more particularly in cases of auricular fibrillation, venesection is sometimes employed, and good results obtained.

Drugs.—In entering upon this part of the subject of treatment of diseases of the heart, one is met by a great number of drugs, for which such potent effects are claimed that it is not possible for one individual to appraise the value of all of them. When, however, the searcher after truth endeavors to find out on what grounds a great number of these remedies have acquired their reputation, he finds such an absence of evidence of value that many of these merit little or no consideration. In taking this line, it might be said that evidence is being wilfully ignored, but we must consider what is evidence. In regard to the heart, we get such unmistakable evidence of the effects of drugs that the proof of any active drug is easy to obtain. The manner in which a drug can modify the action of the heart, the rhythm of the heart, and the blood-pressure can be so readily registered that it is easy to demonstrate the specific effect of any drug upon the heart or bloodvessels. Moreover, other phenomena, as the response to exertion, alteration in the size of the heart, generally go hand in hand with the more demonstrable effects, so that altogether we are in possession of many ways of demonstrating the action of remedies on the human heart. Nowadays the statement of any authority, however eminent, should count for very little, unless he is prepared to give more definite proofs for the faith that is within him than his *ipse dixit*. We need only point to the widely prevalent idea that strychnine is an active and valuable cardiac drug. Yet there is not a single observation, clinical or experimental, of the slightest value to show that strychnine in *medicinal doses* has any effect upon the heart or bloodvessels. The whole evidence is based upon the conclusions drawn from extremely doubtful experiments on the frog's heart, and upon the fact that some patients have fancied they were better after its use. I have already dealt with this kind of evidence when speaking of suggestion (p. 199). These methods of estimating the value of drugs are so widely employed, and lead to such inaccurate and unfortunate results, that it seemed to me, with the great advance that has been made in recent years in our diagnostic methods, and our more exact knowledge of the more common cardiac phenomena, it was desirable that these advances should be used for the study of drugs that affect the heart.

For many years, while engaged in general practice, I had been carrying out an investigation on these lines, and had obtained many striking and instructive results. The subject is a big one, and it required more careful methods than one could apply in general practice, so that when I was given the charge of the cardiac wards at the Mt. Vernon Hospital, Hampstead, Professor Cushny associated himself with me in carrying out a definite series of observations on all sorts of cardiac drugs. As we desired, above all things, to make our observations of real practical value to the general practitioner, we employed the remedies in the form most commonly used in general practice. We elected to begin with the drugs

administered by the mouth, as it is manifestly absurd to expect a busy practitioner to give his remedies by hypodermic or intravenous injections. The following description of the effects of remedies will, therefore, be based upon the results obtained in this way. Needless to say, many negative results are not included here.

When patients came first under our care we put them to bed, and allowed them a limited liberty, according to the degree of heart failure. Any incidental trouble from which they might suffer, as flatulence, constipation, sleeplessness, was remedied. Careful observations were made on their powers of response to effort, estimating the work force of the heart by noting how they performed some standardized exertion. Accurate records were made as to the heart's rate, rhythm, and size, the movements in the arteries and jugular veins, condition of the lungs and respiration, the blood-pressure, the state of the liver and kidneys, the extent of dropsy, and other evidences of heart failure. The daily progress of the case, as measured by these phenomena, was carefully recorded. When the condition was urgent, drugs were given at once, but where there was no urgency, the effect of rest alone was allowed to act, and so long as improvement continued, no drug was given. When no further progress was made, we placed the patient upon such drugs as seemed likely to improve his condition, and that drug was pushed until some physiological effect was shown. The drug was then withheld or diminished, according as the patient's condition seemed to warrant. If the result was not satisfactory, the patient was allowed to come out of the influence of the drug, and another remedy substituted, and the same process repeated. Professor Cushny took samples of the different drugs used and submitted them to a physiological assay, while patients showing any doubtful or obscure action were examined by Dr. Lewis by means of the electrocardiograph. It will be understood that this method of observation is very laborious and time-robbing, and can only be undertaken by those who are familiar with the use of the various mechanical methods employed in the clinical study of the heart, and capable of interpreting accurately the results. While these are still capable of improvement, they afford essential aids in this much-needed line of observation.

Digitalis.—The most valuable cardiac drugs we possess belong to the series which includes digitalis, strophanthus, and squills, these drugs having a remarkable similarity in their action upon the heart. Of these, digitalis is the most useful, and it will be found that if digitalis fails to act, then the others will be of little value. Unfortunately, in some people, accompanying the cardiac action, other effects are produced which are so disagreeable as to prevent the continued use of the drug. Under these circumstances the same cardiac reaction can be obtained sometimes by strophanthus or squills, with less disagreeable effects on other organs.

One peculiar feature about the action of digitalis is the difference in its effects on different individuals. In some there is quickly developed an intolerance of the drug, on account of nausea, vomiting, severe headache, diarrhoea; in others it acts speedily upon the heart, and produces

a different result in different people. In many the effects on the digestive and circulatory system are coincident, the first sign of nausea being accompanied by a marked reaction upon the heart. In others, large doses could be taken for indefinite periods with little or no effect upon the patient, the preparation employed being exactly identical with that which produced a reaction in others. This inconstant reaction is a common experience, and has usually been attributed to variations in the potency of the preparation used or in the capricious nature of the drug. As an outcome of the careful observations of the varied reactions, I have no hesitation in saying that the variability is not due to the drug, but either to the differences in the susceptibility of individuals, or to the nature of the lesion by which they are affected.

Before prescribing such a drug as digitalis, we should have a clear idea of our object. In a great many individuals there may be symptoms referable to the heart, such as a feeling of weakness or palpitation, and some abnormal sign be found in the heart, such as a murmur or irregularity, and, therefore, digitalis is supposed to be indicated, small doses (1 to 5 drops of the tincture) are prescribed, and any good results that may follow are attributed to the small doses of digitalis. While I am not prepared to say that the digitalis has not been of some use in such cases, I can, however, confidently assert that there is never shown any evidence characteristic of the action of the drug with small doses until a considerable quantity of the drug has accumulated in the system. Even in severe cases of heart failure, where rest is enjoined, the good effect of the small doses which have been given has been in all probability obtained by the rest and the accompanying care to protect the heart from excitement. This conclusion has been forced upon me by the careful observations of the effect of rest and small doses, and it needs to be commented upon, for the reason that the faith in small doses is so common in the profession that much injury results from not pushing digitalis in really serious cases.

When there are undoubted signs of heart failure, such as breathlessness on exertion, dropsy, a rapid action of the heart, digitalis when indicated should be given in fair doses, and pushed until some physiological reaction is produced. This physiological reaction varies in different people, and in some its nature depends on the character of the heart lesion.

The most common sign of a sufficient dose is nausea or even vomiting. In a great many cases, as soon as this happens, the heart will be found affected, usually by becoming slow in its rate, continually or at intervals, while, at the same time, there may be dropping out of ventricular systoles (heart-block) or the occurrence of extra-systoles. When this stage is reached, the drug should be stopped for twenty-four hours, or until the nausea has passed off. It very often happens that, as soon as the nausea has passed off, the patient feels remarkably well, and is able to exert himself with less distress, and now the aim is to keep the heart at the rate at which he feels best. This is achieved by giving him half the dose at first and watching to see if the pulse-rate alters, and increase or dimin-

ish the doses according as the pulse-rate increases or diminishes. After a time the patient can tell by his own sensations when he has had enough and when he needs more, and I have found these sensations invariably an excellent guide, and in many cases can leave the future administration of the drug to the patient. This is particularly the case when the patient suffers from old rheumatic affections of the heart, or when auricular fibrillation has occurred. I have watched patients who managed themselves with digitalis over long periods,—ten years or more,—and have never seen anything but good result, the tendency to nausea being a signal to stop and acting as a prevention against an overdose.

In watching cases going under the influence of digitalis for the first time, and when the patient is going about or able to get out of bed, I have found the first effects of digitalis can be detected by observing the rate and rhythm of the heart after exertion. A patient makes some effort, as walking round the room or up one or two flights of stairs, according to his strength and condition. After he lies down, the rate and rhythm of the heart is graphically recorded or the heart is auscultated. After the rapid action in consequence of the exertion has subsided, if the heart is under the influence of digitalis, it will be found to become slower than it was before the exertion was made. The slowing occurs very often periodically, the slow periods separated from each other by 10 to 20 beats. During the periodic slowing, extra-systoles are apt to occur, and in certain cases heart-block. This reaction only occurs when the normal rhythm is present; that is, when the normal auricular systole is followed by a normal ventricular systole. In auricular fibrillation, there is only a marked slowing of the pulse, sometimes with coupled beats and sometimes with long pauses.

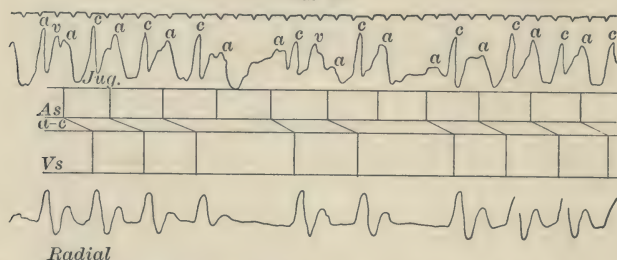
In discussing the physiological action of the digitalis too much reliance has been placed hitherto upon the results of experiment, the supposition being that similar effects would be shown on the human heart, while little or no consideration has been given to the fact that the human heart, to which digitalis has been applied, is the seat of a disease process which may profoundly modify the heart's action, and in consequence produce results which cannot be obtained by experiment. It is commonly asserted, for instance, that as digitalis acts upon the muscular wall of the arteries, it is useful to raise blood-pressure, and is contraindicated in cases of high blood-pressure. In all our observations made at the Mt. Vernon Hospital, as well as those made for many years in private practice, we have never found a single instance where the blood-pressure was noticeably raised, but a great number in which it was lowered.

A great deal of good results from the slowing of the heart's action. I have already referred to the fact that a pause of extreme brevity in the diastole of the heart is enough to increase greatly the strength of the following systole. This slowing by digitalis probably acts through stimulation of the vagus, and all the chambers of the heart take part in the slowing. In addition to this slowing of the heart, as a whole, a still further slowing of the ventricle is sometimes found, due to the fact that

the stimulus fails to reach the ventricle after the auricle has contracted (partial heart-block). In nearly all the cases when this occurs there will be found in the jugular tracing an increase in the interval between the wave due to the auricle and the wave due to the carotid (a wide *a-c* interval) (Fig. 19). It can with fair certainty be assumed that in such cases there is some damage to the auriculoventricular bundle, and this is one of the instances where the reaction due to digitalis is dependent on a lesion in the heart.

I have always found, when digitalis slowed the heart in this manner, either with a slowing of the whole heart, or with the occurrence of partial heart-block, that the patient was much better—could breathe easier and do more exertion with comfort—and in treatment the digitalis should not be pushed beyond this stage. I generally stop it for a day or two, and then resume with smaller doses of sufficient strength to

FIG. 19.



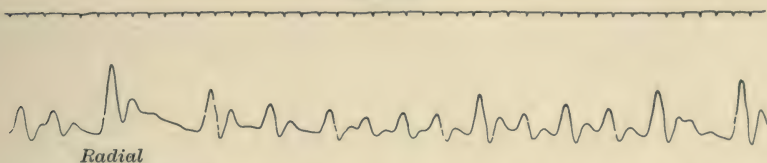
Simultaneous tracings of the jugular and radial pulses, showing intermission of the radial pulse. The intercalated diagram represents the auricular systoles (*As*) by the downstrokes in the upper division, and the ventricular systoles (*Vs*) by the downstrokes in the lower division, while the passage of the stimulus from auricle to ventricle is represented by the slanting line in the middle division (*a-c*). It will be seen that during the pause in the radial, the stimulus failed to pass from auricle to ventricle, the passage being "blocked." This reaction occurred after 19 granules of digitalin had been taken.

maintain the slow action, guided also by the patient's sensations of improvement.

While digitalis is of use in different forms of heart lesion, it is in cases with auricular fibrillation that it acts with almost a specific efficacy. Where digitalis has been given to patients with extreme heart failure, when the patient was evidently in peril of his life, and where in a few days a great and striking alteration has occurred, all my cases have been those whom I have hitherto described as cases of "nodal rhythm," but which we now recognize as due to auricular fibrillation. In searching the records in literature for the evidence of the good effects of digitalis, I feel fairly certain that it is in patients with auricular fibrillation, particularly when it is subsequent to rheumatic fever, that the extraordinary good results have been obtained. If one reads carefully the records given by Withering in the first valuable account of digitalis in 1785, though he only used it as a diuretic, yet he noted its good effects

in heart cases, and several of his successful cases had undoubtedly auricular fibrillation. I have repeatedly seen patients in the direst distress greatly relieved and freed from danger in the course of a few days. It is seldom that one can really claim to have saved a patient from imminent peril by the use of drugs, but I think I am justified in saying this has frequently been done by the administration of digitalis. We may find a patient suffering from severe dyspnoea, unable to lie down, the pulse very rapid and irregular, and the liver pulsating three or four inches below the edges of the ribs. By giving him sufficient digi-

FIG. 20.

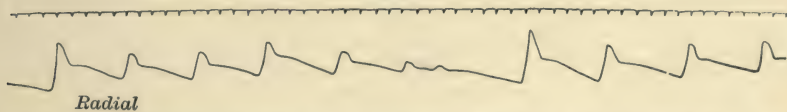


Tracing of the radial pulse, showing the irregularity characteristic of auricular fibrillation, during a period of severe heart failure. Rate, 115.

talis, in the course of a few days the heart's rate is markedly diminished, the distressed breathing is gone, the liver is scarcely perceptible below the ribs, the patient is able to lie flat, to sleep, and to walk quietly about in comfort.

I describe later the characteristic symptoms by which the condition of auricular fibrillation can be recognized. The mode of action of digitalis seems to be by slowing of the ventricular rate. (See Figs. 20 to 23.) As records of the jugular pulse and observations by means of the electrocardiograph show, the auricle is still in fibrillation; it is not by the action

FIG. 21.



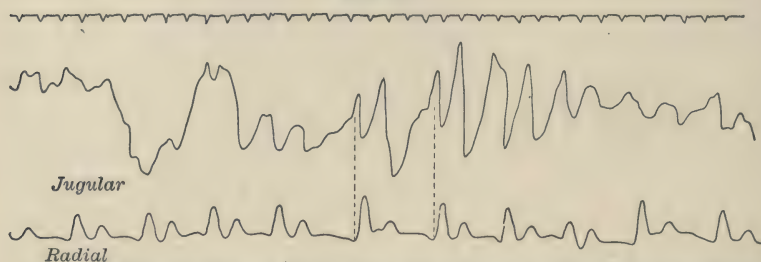
From the same patient as gave Fig. 2 after three drams of tincture digitalis. The patient's condition had greatly improved. Rate, 55.

of digitalis on the auricular muscle that the slowing is produced. If we assume that in fibrillation of the auricle many of the numerous stimuli arising in the auricle are sent through the *a-v* bundle to the ventricle as fast as the bundle or the ventricle can receive them, then, by depressing the conductivity of the bundle, or the susceptibility of the ventricle, fewer stimuli will pass, and the ventricle will have more time for rest and for restoration of its strength. In view of the fact that digitalis can be shown to depress readily in some cases the conducting function of the bundle, it is in all likelihood that it is by its action in this manner that it does so much good in auricular fibrillation, so that, notwithstand-

ing the persistent fibrillary action of the auricle, the ventricle is protected from this irritability. This effect is produced probably through vagus stimulation, though it is possible that there may be a direct effect upon the bundle or on the fibres of the ventricle dulling their susceptibility.

In addition to the slowing of the ventricular rate, other effects of the digitalis may aid its beneficial effect, as its action upon the contractile

FIG. 22.

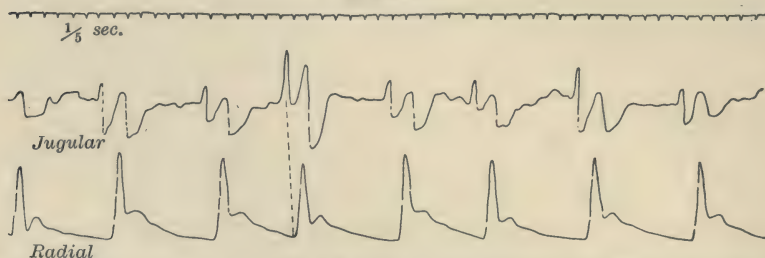


Simultaneous tracings of the radial and jugular pulses in a case of mitral stenosis with auricular fibrillation during a period of severe heart failure. Note the irregularity of the radial pulse, typical of auricular fibrillation. Rate, 105.

force or upon the tonicity of the heart muscle. In regard to the latter action, it is certainly in cases of dilatation of the heart that the best results are seen, though I have been able in relatively few cases to make out much diminution in the size of the heart when there has been otherwise a marked reaction on the heart.

Although digitalis has this marked effect upon patients with auricular fibrillation, yet it is only in those where the heart muscle itself is fairly

FIG. 23.



From the same patient as gave Fig. 22, when six drams of tincture digitalis had been taken. The patient's condition had greatly improved. Rate of pulse, 50.

healthy, for in the auricular fibrillation of the elderly, with senile changes in the heart muscle, I have frequently failed to get any effect from the digitalis.

When there is dropsy present coincident with the improvement in the heart, the flow of urine often becomes markedly increased. In cases without dropsy very little change has been noted in the quantity of

urine passed, even when the heart has become much slower and the patient's condition has been greatly improved.

Preparation and Method of Administration.—As a result of my experience, I prefer to push the digitalis until some physiological reaction occurs, as nausea, diarrhœa, slowing of the heart, etc. I am confident, if an outlook is kept for such signs, that there need be no fear of poisoning or of any deleterious effect. The dose, therefore, in any given case partly depends on the nature of the case. In giving the tincture to an adult, doses of 15 to 20 minims, thrice daily, usually produces its effect in from three to seven days. If the distress of breathing is great and the pulse rapid, double the quantity may be safely administered, and the physiological effect looked for in twenty-four to forty-eight hours.

The form of preparation I have used as a standard is the tincture, which I have never yet found to fail me. If it can be obtained of a guaranteed strength, well and good, but I soon find out for myself whether it is active. I use the tincture because it is handiest and the most reasonable in price, a very important consideration to the general practitioner in practice among the working classes. A more elegant preparation may be used, and I have made a large number of observations with digitalin (Nativelle's granules). Each of these granules I have found to have had the same effect as about 15 minims of the tincture. Many patients themselves buy the leaves and make an infusion of variable strength, but they get to know the physiological effect and treat themselves. One man whom I have had under observation for ten years with auricular fibrillation uses as a standard the degree of swelling in his legs, his test being that when he cannot comfortably lace up his boots, it is a sign to take his home-made infusion of digitalis.

So far as I have seen, there is no special virtue in the various extractives obtained from the digitalis leaf and I see no ground for according them priority over such a preparation as the tincture, which includes all the different glucosides.

In persistent dropsy due to heart failure greater benefit may be obtained when the digitalis is combined with mercury and squills (as, for instance, mercurial pill, 2 gr.; powdered digitalis leaves, $\frac{1}{2}$ gr.; squills, 1 gr.). This combination is often useful when digitalis by itself is without effect. One patient received much benefit from this preparation, but she was so salivated by the mercury that the medicine could not be used a sufficient length of time. A number of other preparations of digitalis and strophanthus were tried without effect. At last the patient took the pills with her food, and for some reason she was not again salivated and was able to keep her dropsy in check.

It is possible that a more speedy effect may be attained by hypodermic injections of digitalis, but in the few instances I have seen it used it showed no appreciable effect. Unfortunately, it is used too often when the patients are dying from some grave affection, as pneumonia, as a last resort, probably more for the purpose of doing something than with expectations of great benefit. I have never seen much good follow the administration of digitalis in acute febrile states. The factors exciting

the heart (high temperature, toxins, or the invasion of the heart by specific organisms) exert an influence over the heart which the digitalis cannot withstand. I think it desirable to mention this, as it is a waste of time and opportunity to apply remedies which are of no avail in urgent cases, while, by recognizing their uselessness, we may search for more helpful measures.

The recommendation of digitalis is usually accompanied by warnings as to dangers which may result from its use. It would be of great advantage if writers would state clearly what the danger is of which they are afraid. So long as vague statements are made that such a drug should be used cautiously or sudden death may result, the reader is oppressed by some fear, which is all the greater because of the indefinite nature of the warning. If writers would even give the experience which led them to make use of their warning, the value of their experience might be ascertained; but when they limit their injunctions to obscure hints, they play upon the characteristic weaknesses of human nature, for the mysterious and the unknown inevitably provoke fear, whereas the bare citation of the writer's experience would very likely rob the whole statement of the mysterious and therefore of the fearsome. I state this because I have failed to recognize these cases where there is danger in the use of digitalis. I can imagine that danger might arise if the drug was pushed beyond the limits indicated by the first signs of its physiological action, and I can only say that, in over thirty years' familiar use of the drug, I have never yet seen any evil result from its use when given in the manner I have indicated. I have seen great distress arise from overdosing when others have given it, and neglected the physiological signs of sufficiency; I have known a patient with auricular fibrillation die suddenly when taking digitalis, but I have known others die equally suddenly who were not taking digitalis. When we reflect that digitalis is given to nearly all individuals who are supposed to be suffering from a heart affection, and that patients do die suddenly from heart affections, it is not unlikely that patients with heart affections, and who are taking digitalis, may die suddenly, but it is illogical to state that the digitalis is, therefore, of necessity the cause of sudden death.

In the recommendation of the use of the drug, I have followed the results of my own experience and that of some other observers. It is but right to state that there are authorities who recommend digitalis in much smaller doses, even in grave cases, and some find evidence of its good effects in the course of a few minutes, others in the course of a few hours. H. A. Hare recommends, with rest, not more than 5 drops of the tincture three times a day. He thinks large doses are only justified when the heart is in an exceedingly feeble state, and the patient's condition is so critical that immediate stimulation is necessary.

Strophanthus.—As in the case of digitalis, there seems to be a discrepancy between the experimental and the therapeutic results when applied to human beings.

“Strophanthus acts as a stimulant to the heart muscle and its ganglia, but does not slow the pulse by its action on the vagus as does digitalis”

(Hare). As an outcome of my own experience in private practice and researches at Mount Vernon Hospital, no distinction can be made between the reaction of these drugs. Patients whose hearts are affected by digitalis in a peculiar manner are affected in a like manner by strophanthus. The slowing, which is accepted to be due to vagus stimulation is produced by both, so that what I have written of digitalis applies to strophanthus.

In some cases there was not so marked an effect upon the digestive tract, although in other cases the reaction was just as severe. The headache, too, was found to arise from both drugs in the same individual.

Taking the B. P. tincture as our standard drug, we found in most cases about twice as much tincture of strophanthus was required to produce the same effect as the digitalis. When Professor Cushny tested physiologically the two tinctures, he found in the exposed heart of the frog the tincture of strophanthus was thirty times stronger than the digitalis tincture. From this we can infer that the absorption of the tincture of strophanthus from the digestive tract is in some way interfered with.

The difference in the relative activities of the two drugs was impressed upon me several years ago by a young man whom I saw in consultation. His heart was affected by a rheumatic lesion, he had mitral stenosis and auricular fibrillation. For years he had been accustomed to keep his heart fit by taking digitalis. When I asked him if he had tried strophanthus, he replied that he had, but that it took twice as long to get as good a result.

In somewhat urgent cases of old rheumatic hearts, when there was auricular fibrillation, I have seen remarkably good results follow big doses of the tincture of strophanthus—as much as three drams in one day. Within thirty-six hours sickness and nausea were experienced, but, at the same time, the heart's action had become much slower and the patient's general condition improved.

Strophanthin has been used intravenously by several observers, and in some of the recorded cases marked results were obtained. The most instructive paper on this object is one by H. C. Bailey, where a number of cases are detailed with graphic records. From the study of these records we can recognize the nature of the heart affection, and the best marked reactions were obtained in cases of rheumatic hearts with auricular fibrillation. From this we can conclude that the reaction in these cases is practically the same as might have been expected from full doses of the tincture of digitalis or tincture of strophanthus. The reaction is certainly much more rapid, and we can understand that in exceptional cases it might be necessary to obtain this rapid action, but such cases must be exceptional, for I do not recollect any case where there was such urgency as could not be met by full doses by the mouth; still it is well to know that we can have the prompt effect of strophanthus in this manner.

Bailey used doses of half a milligram of crystallized strophanthin in his intravenous injection, and got evidence of its effect upon the heart in one hour's time. The effect of such a dose passed off in twenty-four hours' time.

Bachman records a case of complete heart-block, where the intravenous injection of strophanthin was followed by a quickening of the ventricular rate from 30 to 35 beats per minute. This suggests the possibility of its employment in those cases of heart-block with great infrequency of the pulse-rate, leading to attacks of loss of consciousness and convulsions (Adam-Stokes syndrome).

Squills.—In a few cases where digitalis and strophanthus were not well borne because of trouble with the digestion or headaches, we have obtained very satisfactory results with the tincture of squills, carefully pushed. Its physiological effect is identical with that of the other two drugs, and the reaction can be obtained in about the same time and in the same doses as with the tincture of digitalis.

The Nitrites.—The principal effect of the nitrites upon the blood-vessels is to cause dilatation of the arteries and veins. It is now accepted that the cause of the dilatation is by the depression of the nerves and muscles of the vessel-walls. This effect is accompanied by an acceleration of the heart rate and a great fall in the arterial pressure.

When, for any reason, a sudden effect is wanted upon the heart, the nitrites are the most potent of drugs for the purpose. A few drops (3 to 10 minims) of nitrite of amyl inhaled produces its effects in a few seconds. The face becomes flushed, and the patient becomes conscious of throbbing in the head. If continued, the patient becomes faint and giddy and is forced to lie down. It should never be pushed beyond this stage. In a few moments the effect has passed off, and the blood-pressure, which has undergone a sudden fall, gradually rises, and may even become higher than it was before the inhalation.

Other nitrites, as nitroglycerine (dose $\frac{1}{10}$ gr. in tablets or in alcoholic solution), erythrol tetranitrate (dose 1 gr. in pills), sodium nitrite (1 to 2 gr. in pills or solution), act in the same way as amyl nitrite, but slower, and the effect remains longer.

Spiritus ætheris nitrosi (sweet spirit of nitre) is a very popular remedy. It contains traces of ethyl nitrite, and is often prescribed in doses of 30 to 60 minims for its supposed effect in relaxing the vessels. As it is usually prescribed in mixtures with water, the nitrite which it contains rapidly evaporates and the resultant effect is due to the ether and alcohol.

The best therapeutic effect of nitrites is obtained in cases requiring rapid action, as in angina pectoris. Some of the slower-acting nitrites are recommended to reduce high blood-pressure, but I have had no satisfactory results from them when used for this purpose, nor does it seem a reasonable procedure to use them, when the increased blood-pressure may be due to some irritating substance circulating in the blood, as in kidney disease.

Iodide of Potassium.—The iodides, particularly the iodide of potassium, have obtained a reputation as a drug of great therapeutic value in cardiovascular disease. The undoubted good results seen in syphilitic affections have led to its employment in such conditions as aneurysm, and Balfour and Bramwell have particularly extolled the virtues of iodide of potassium in this affection.

It is frequently used in all sorts of senile changes in the heart and bloodvessels, and remarkable virtue has been attributed to its action. It is difficult to understand, however, how it acts. It used to be held that it lowered the blood-pressure, but careful observations seem to indicate that it has little effect on the blood-pressure. Many suggestions have been made as to its action on the walls of the bloodvessels, but the proof is purely speculative. The fact that some observers say that it is necessary to give large doses (20 to 30 gr. three or four times a day), while others claim equally good results from doses of 5 to 10 gr., seems to indicate that the resultant benefit may be due to the alteration in the patient's habits which accompany the use of the drug, as rest, change of diet, etc.

Sedatives.—Little benefit is likely to arise from treatment so long as a patient is worried and sleepless. I have already referred to the importance of rest, and it is often necessary to seek the aid of drugs to obtain rest and sleep and freedom from worry and other excitations, and sedative drugs used with discrimination are of the greatest use.

The bromides are the most useful drugs in this respect. In all cases of mild degrees of heart failure, where the patient is able to get about, but where he is worried, sleepless, irritable, or apprehensive, the bromides are extremely useful and of far more value than other cardiac drugs. I have for many years employed the bromide of ammonium, being under the impression that the patients were not so depressed from its use as from the bromide of potassium, but this may be a false impression, as I have not compared the effects with sufficient precision. The drug should be pushed until a slight lassitude is induced, or even until the patient becomes torpid, particularly in severe cases of angina pectoris. The doses employed are 20 grains, two to four times a day, according to the severity of the case.

For sleeplessness, the milder hypnotics may first be tried, as the bromides, acetanilid, veronal or sulphonal, but, if these fail, resort must be had to chloral or opium. In great restlessness, due to dyspnoea, Cheyne-Stokes respiration, cardiac asthma, one of these drugs should be carefully pushed until the desired effect is obtained—5 to 10 gr. of chloral every two hours, or $\frac{1}{4}$ gr. of morphin ($\frac{1}{8}$ gr. hypodermically), repeated every two hours, will often suffice. When there is œdema of the lungs or bronchitis, the opiates should be avoided, as they tend to check the free expulsion of the phlegm and danger may arise from this cause.

Oxygen.—The administration of oxygen in affections of the heart has been followed for many years, but the results, on the whole, are disappointing, though there is a limited field where it seems to be of use. It is difficult, however, to describe the condition that calls for its use, and I have given it in a great variety of cases, in some with excellent results, in the majority with no appreciable benefit, or only temporary relief. Even in patients suffering apparently from similar affections the results have been very unequal; for instance, a few patients suffering from cardiac asthma have been greatly relieved, while others have experienced no

benefit. This difference in effect caused me to look more carefully into the symptoms present, and I found that those who got benefit had always evidence of cyanosis.

The conditions in which I have found oxygen of benefit are in some cases with Cheyne-Stokes respiration, cardiac asthma, angina pectoris, and heart-block; sometimes in cases of angina and cardiac asthma the patient has had better nights when the oxygen has been taken for a quarter of an hour before going to bed. In most cases relief has occurred when the oxygen was taken during the attack of dyspnoea or pain, and, in cases of heart-block, during the attack of unconsciousness.

I have followed Leonard Hill's methods of administration by giving the patient large doses. Hill employs a mask which encloses the patient's head, and the oxygen is poured into the mask from the cylinder, so that the patient breathes practically pure oxygen. I have used in many cases a lady's hat-box, in which a piece is cut out for the neck, and the head enclosed in the box and the lid put on it, and the oxygen given through a hole in the box. The head is then surrounded by an atmosphere of almost pure oxygen. By this method, Hill states a far greater amount of oxygen is taken up in the blood. The duration of an administration lasts from ten to twenty minutes.

Aconite.—In medicinal doses, aconite is supposed to act upon the heart through vagus stimulation, and a very current impression is that it is a powerful drug in slowing the heart and in weakening its action, and the dose, when given frequently, is stated to be from 2 to 5 minims of the B. P. preparation. In a series of observations on its action we carefully increased the doses of the tincture in a number of patients until 15 minims were taken every two hours for several days, but, though accurate records were kept of the pulse-rate, blood-pressure, and the patient's sensations, no effect was observed. Presuming that the preparation was not a good one, we tried others,—so-called standardized preparations,—and the same absence of result was experienced. We then tried aconitine, beginning with doses of $\frac{1}{160}$ gr., gradually raising the dose to $\frac{1}{80}$ gr. every four hours. After a couple of days the pulse-rate was, if anything, increased, the patients felt a good deal of discomfort, a disagreeable pricking sensation in the throat with a sensation of choking, numbness of the limbs, a good deal of sweating, and, toward the end of the observation, painful consciousness of the heart's action, which at times would beat violently and rapidly. In cases of auricular fibrillation with rapid heart action, when digitalis produced slowing, no slowing resulted from the aconite.

I do not see what place aconite should occupy in treatment, as far as its effect upon the heart is concerned.

Atropine.—The principal effect of atropine upon the circulatory system is said to be due to its action in paralyzing the cardiac inhibitory terminations. In practice, it has been found to be of use in rare cases of heart-block, where there has been some difficulty in the passage of the stimulus from auricle to ventricle. When this occurs, an increase of the difficulty may result in the stoppage of the stimulus passing, and, as it is

well known that vagal action does produce this delay in the conduction of the stimulus, atropine, given in such cases, may cause removal of the heart-block. In a few cases it has been found that in an attack of Adams-Stokes convulsions the injection of atropine has apparently given temporary relief, by increasing the rate of the ventricular contraction. My own experience is too limited to permit me to speak of this matter with any authority, but, seeing that all remedies are, as a rule, of little help in patients with attacks of loss of consciousness due to heart-block, this remedy should be given a fair trial.

It should be given by hypodermic injection in doses of $\frac{1}{100}$ gr., and repeated in half an hour if necessary.

Other Drugs.—A great number of agents are used in therapy, but it is doubtful if many of them have any real effect on the heart. Some undoubtedly can show evidence of a reaction, as *alcohol* and hot fluids; their activity in producing a dilatation of the arterioles can be employed with benefit when a rapid effect is desired, as in attacks of faintness or prostration. It is scarcely necessary at this time of day to add a warning as to the use of alcohol in milder forms of heart failure, and particularly in those with a neurotic tendency. The temporary benefit obtained may lead to a too frequent use, with the danger of a habit being created.

Other drugs, as *caffeine*, *strychnine*, act probably on the nervous system, and, by producing some exhilaration, prove useful in cases when a temporary exhaustion causes distress. But it cannot be too strongly insisted upon that, though they are commonly employed in extreme cases of the most diverse kind, for instance, as where there is a rapid heart in pneumonia, and where there is a sluggish ventricle in heart-block, their usefulness is very doubtful and of a very limited kind, and should not be relied upon in cases of real heart exhaustion.

SYMPTOMS AS INDICATIONS FOR TREATMENT

While the principles which have been laid down for the treatment of heart failure are applicable to cases where the heart fails to maintain an efficient circulation, there are a great many symptoms which cause distress to the patient, actual physical discomfort, or mental distress, and which may give grave concern to the physician who does not clearly realize the significance of the symptoms. I, therefore, deal with the more prominent of these symptoms, indicating which need no treatment, and giving the results of my own experience of such as call for treatment.

Abnormal Action of the Heart (Irregular Action, Tachycardia, Heart-block).—The most common form of abnormal sign, or what is taken for abnormal sign, is irregular action of the heart. Up to twenty years ago irregular action of the heart was among the most obscure affairs in the practice of medicine. Writers up to quite recent dates either ignored the symptom, or dealt with it so perfunctorily that, if one were to judge from the literature, the symptom might be of little consequence and of rare occurrence. In every day practice the observing physician could not but be struck by the great frequency of irregular action, and the

dread with which it is viewed by patients and physicians alike. It is no exaggeration to say that the persistent study given to the subject by observers during the last twenty years has not only demonstrated the great frequency of the symptom, but has thrown such a flood of light upon heart irregularities, and upon their bearing on the patient's condition, that few subjects in clinical medicine are better understood now. Not that the subject is exhausted, for there are many abnormal actions of the heart that are still obscure, but the great majority of cases can be readily recognized. I shall deal here with those that are the most common.

When a large number of cases of irregular action of the heart are studied, three great groups can be separated, which include probably 95 per cent. of all cases. These groups can be differentiated not only by the mechanism of their production, but to a great extent by the type of individual in which they occur, one group being more frequent in the young and healthy, another group being more frequent in the later years of adult life, and another more frequent with chronic disease of the heart muscle or valves.

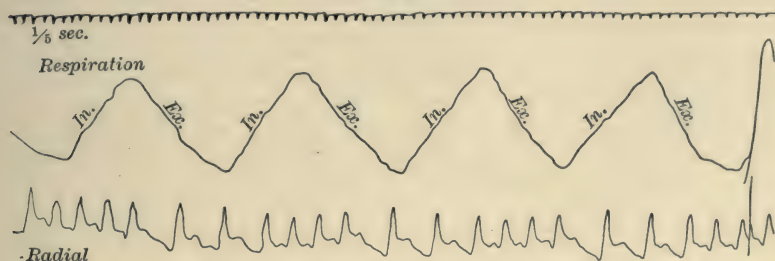
These three groups I will describe under the headings of the Sinus Irregularity, Extrasystole, and Auricular Fibrillation. I enter somewhat fully into their cause and the means of recognizing them, for, with a thorough knowledge of the irregularity, one is the more able to separate those that need treatment from the great majority that require no special treatment.

Sinus Irregularity.—This form of irregularity is characterized by a varying duration of the cardiac cycle, the difference in time being due to the varying lengths of the diastolic period. It is only present when the patient is at rest, disappearing on an increase of the heart's rate from any cause, such as exertion, fever, excitement. In the great majority of cases it is respiratory in origin, the rate increasing during inspiration and diminishing during expiration, but occasionally the reverse may be found, a quickening during expiration, or no distinct relation between the arrhythmia and definite phase of the respiratory cycle is found, as in Fig. 24. At other times, though probably respiratory in origin, it is not so entirely, and may occur altogether independent of the respiration, especially when artificially induced by means of digitalis. In rare instances periods of slowing may occur with no relation to the respiratory rhythm and quite independent of it. It can generally be recognized by the finger on the pulse, and by listening to the heart sounds, when the sounds of each heart-beat will be heard clear and distinct, and no difference, or a very slight difference, between the first and second sounds, however varied the duration of the cardiac cycle may be. Graphic records, especially of the radial and jugular pulses, may be necessary to appreciate the rare cases where the slowing is independent of the respiration.

This arrhythmia occurs mostly in the young, from the time the heart begins to slow down in early childhood until between twenty and thirty years of life, though it may persist beyond thirty years. It occurs very

markedly after the subsidence of a febrile attack, or when the heart has slowed down after exertion. If not present, it can often be induced by slow, deep respirations. The cause of this arrhythmia is, in all probability, vagal stimulation, the vagus being acted upon by the respiration. It is present often in the dog, and disappears on section of the vagus. It is a slowing of the whole heart, the auricle and ventricle both being affected, and it is assumed that this variation in the rate arises from the

FIG. 24.

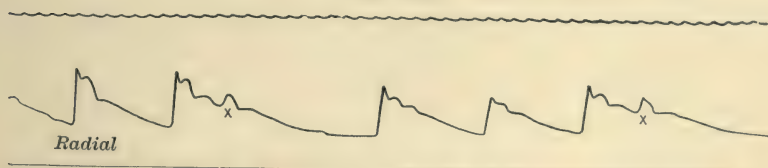


Shows the irregularity characteristic of sinus arrhythmia (youthful type of irregularity). The irregularity appears at fairly regular intervals, but the respiratory phases are more frequent than the irregular pulse period.

action of the vagus on the starting-place of the heart's contraction, in the remains of the sinus venosus, hence the term, sinus irregularity.

This condition calls for no treatment. If the individual shows at the same time any evidence of weakness, treatment should be directed to restoring his general state of health, but not to the heart. In fact, so far from being evidence of heart affection, it will be found to be an evidence of a healthy heart muscle, for so far I have not found it in any

FIG. 25.



Radial tracing, showing the occurrence of a small premature beat (x), due to a ventricular extrasystole, followed by a long pause.

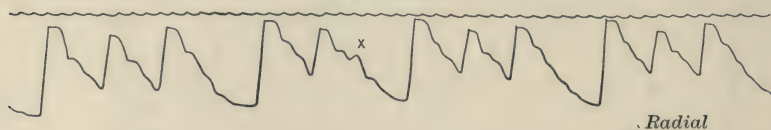
cases of serious affection of the heart muscle. The reason for this is that the vagus only exercises this control when the heart muscle is healthy and free from any exciting cause.

Extrasystoles.—By far the most frequent form of heart irregularity is the occurrence of a premature contraction of the auricle or ventricle, or both together, before the stimulus for contraction comes down from the normal starting-place. These premature contractions are called "extrasystoles" (Fig. 25). They may be detected by the finger, as small

beats followed by a long pause. The beat succeeding the pause may be big and full. Sometimes the small beats are not detected, and then the impression is given that the heart has dropped a beat, and the pulse is spoken of as "intermittent" (Fig. 26). If the heart be auscultated while extrasystoles are occurring, the sounds produced by the extrasystoles are readily recognized—two short sharp sounds occurring too soon and followed by a pause. Occasionally there is only one of the sounds present, and sometimes no sound can be detected during the long pause. The extrasystoles may occur at rare intervals, or after every few beats, or every second beat may be an extrasystole (*pulsus bigeminus*) or every third, fourth, or fifth beat. They may be present at every examination, or, what is more common, they may appear for a time and then disappear for long or short periods.

Usually the patient is unconscious of their presence, and is alarmed at his doctor telling him that he has an intermittent or irregular heart. The patient may be conscious of the pause, and feels frightened lest the heart should stand still, and is painfully conscious of the big after-beat. As these extrasystoles occur frequently during the night, when the heart

FIG. 26.



Radial tracing, showing an irregular pulse, due to the frequent occurrence of extrasystoles. At *x* one extrasystole has affected the radial pulse, while the others have failed to be perceptible, giving rise to one form of "intermittent pulse."

is otherwise acting slowly, patients, particularly neurotic patients, are greatly distressed.

For the vast majority of individuals these extrasystoles are of no serious significance, and the treatment should begin by fully assuring the patient that they are in no sense of any serious importance. In certain individuals tobacco, or some digestive disturbance, or some article of food, as tea or coffee, predisposes to them, and the alteration of the diet and the omission of the offending article is quite sufficient to stop their occurrence.

In neurotic people, when the occurrence causes distress, especially in the night, pretty full doses of bromide of ammonium (20 gr., two or three times a day) usually give relief. In the vast majority of cases drugs are of no use in stopping them. Many drugs have a reputation for stopping them, even digitalis, which readily provokes them in some cases, but it will be found that there are periods during which the extrasystoles are of frequent occurrence, and long intervals when they are absent, and the cessation of the extrasystoles are, in these cases, quite independent of the drug.

When the extrasystoles persist for months and years, no kind of treatment appears to be of use in stopping them. I have carefully pushed many kinds of drugs in these persistent cases, and could find none that had any effect on the extrasystoles.

Auricular Fibrillation (Nodal Rhythm, Continuous Irregularity of the Heart).—There is one important group of patients in whom the most typical symptom, and the one easiest to recognize, is a continuous irregular action of the heart, an irregularity which it is difficult to characterize otherwise than by the term disorderly, and a better appreciation of this disorderly irregularity can be obtained by looking at such tracings as are shown in Figs. 2-5. In these tracings cardiac cycles are seen to be continually varying in length, and no beats of exactly the same length follow one another.

This condition has been an object of special study by me for over twenty years, because I have found that 70 to 80 per cent. of the cases with really serious failure of the heart belonged to this class. The chief clinical feature I had found in the study of these cases was that, as soon as the irregularity appeared, all evidences of the auricular systoles disappeared. For many years I wondered what had happened to the auricle. In the first post-mortem examination I made of one of these cases I found the auricle greatly distended and thin-walled, and I supposed the auricles must have been paralyzed, and in my book on the study of the pulse (1902) I ascribed the condition to "paralysis of the auricle." Later I found cases in which I had seen the onset of this irregular action, and which I had watched for years, and at the postmortem examination the auricle was found hypertrophied, and I reasoned that, being hypertrophied, it must have contracted, and, as it did not contract during ventricular diastole, it must have contracted during ventricular systole, so I inferred that the starting of the contraction must be somewhere that would affect auricle and ventricle simultaneously, and I suggested the node of tissue in the auricle from which the auriculoventricular bundle springs, and gave to this condition the name of "nodal rhythm."

In 1905 Cushny and Edmunds suggested that some of these cases might be due to auricular fibrillation, a condition where the individual muscle-fibres of the auricle wall are contracting and relaxing independent of one another, but so rapid and disorderly that the result is practically a standstill of the auricle as a whole. In 1905 I detected evidence of the auricular fibrillation in some jugular tracings, but I did not fully realize the significance of these tracings until Lewis, in 1909, showed the exact resemblance between this condition produced experimentally and the clinical condition, not only by means of the graphic records of the arterial and venous pulses in animals, but also by the electrocardiograph.

The recognition of this condition is of the greatest importance, because the starting of auricular fibrillation is often the immediate cause of extreme heart failure and of death. As I have already said, the majority of cases of serious heart failure are associated with this condition, and in many cases it is the direct cause of the failure. Once we

recognize the condition we can often do a great deal of good by judicious treatment.

This irregular action generally arises in connection with two morbid states—(1) In rheumatic hearts, most commonly those having mitral stenosis; (2) in the late years of life, when there are fibrous changes in the heart muscle. There has been found in all the cases I have had examined, both in rheumatic hearts and in the senile form, fibrous or inflammatory changes in the heart muscle wall of both auricles and ventricles, and it is likely that this may be the immediate cause of the fibrillation.

To understand the treatment of these cases it is necessary to realize how the irregularity is produced. Normally, the stimulus for contraction arises at the mouth of the superior vena cava, and the stimulus passes to the auricle, which contracts and excites the node of tissue in its wall from which the auriculoventricular bundle arises. From here the stimulus passes by the auriculoventricular bundle to the ventricle, whose contraction normally follows after the auricular contraction. But in fibrillation, there seems to arise in the auricle a continuous shower of stimuli, which, falling upon the node, excites it to send stimuli to the ventricle as rapidly as the bundle or the ventricle is capable of taking them up. Hence, in the first onset of fibrillation we may find the ventricular contraction very rapid and irregular. If the rapid action persists, the ventricles become exhausted, and the patient may die in a few days or in a few months after the event. If, however, from any cause the ventricle can be made to beat at a slower rate, then the patient may lead a useful and even vigorous life for many years. In some cases the fibrillation does not cause a very rapid action at its inception, while in a few it may actually be accompanied by a diminished rate (I have published a series of such cases under the term "Nodal Bradycardia"). The reason for this slow rate seems to be an affection of the bundle, which delays the conduction of the stimulus from auricle to ventricle.

The onset of this irregularity is usually quite sudden. In some cases it starts with a rapid action of the heart, and the patient is conscious of a fluttering in the chest, and the pulse is found to be rapid and irregular. This may last for a few minutes, hours, days, weeks, or even months (see Paroxysmal Tachycardia), and the heart may at any time suddenly revert to its normal action. On the other hand, the rapid, irregular action may persist and the patient's strength speedily become exhausted, so that within a few hours he is conscious of breathlessness and is forced to keep his bed, and to sit upright with labored breathing, while dropsy may speedily supervene. These results may come on more gradually, and all stages may be met with, up to cases where the patient is quite unconscious of the irregularity having started.

In the heart itself changes occur, a presystolic murmur, which may have been heard, disappears, and the heart may dilate. It is the combination of dilatation of the heart and rapid rate that are the chief indications of grave significance.

The reason that I enter into this explanation, and dwell upon these dif-

ferent types of cases is that we get from their study the grounds for a rational treatment. Drugs of the digitalis group act often by depressing the conducting power of the auriculoventricular bundle, probably through the vagus, or it may be the digitalis acts on the ventricle, dulling its sensitiveness. Recognizing that the rapid rate of ventricular contraction leads to exhaustion, and that those cases where there is no increase in rate do not suffer from serious heart failure, the best way to save the ventricle is to diminish its rate. This digitalis often does in certain cases in a remarkable manner.

The most grave sign in this form of heart irregularity is increased rate, 100 to 150. If this rate is not reduced the patient drifts inevitably to a fatal issue. To reduce this rate digitalis should be pushed vigorously until a physiological reaction is produced, or until the pulse-rate comes down under 80 beats per minute. I usually give 15 or 20 minims of the tincture three or four times a day, and look for good effects in three to five days. If it cannot be tolerated, because of nausea or diarrhoea, I substitute tincture of strophanthus (given in doses of 20 to 30 minims), or tincture of squills, and steadily push them until a reaction is obtained. In the majority of cases, especially those with a rheumatic heart, these drugs act well; in some cases, with extraordinary good effect.

Whenever a suitable drug, which acts beneficially upon the heart, is found (and in the vast majority of cases a digitalis preparation is the best), that dose should be administered which best keeps up the good effect. In finding this the patient's sensations are often the best guide, and usually he speedily knows when his heart is failing, and can regulate the drug so that the best effect is maintained.

In addition to the prescription of drugs, the patient should be treated according to the degree of heart failure present. If breathless or dropsical, he should be kept in bed and attention paid to his diet, sleep, etc., as already described. If able to go about, the amount of exertion should be strictly limited to what he can do without distress. This amount is so variable that each case must be taken on its own merits and the whole circumstances considered. Many need only a very slight restriction, while others are quite unconscious of the onset of the irregularity, and pursue even laborious occupations with no discomfort, perhaps only conscious of a slight limitation in going up a hill. When it is discovered accidentally, and the patient is not inconvenienced by it, there is no need to employ any form of treatment, and the patient should simply be warned not to do work or expend his energy when it entails symptoms of exhaustion.

The foregoing gives briefly the results of treatment according to our experience at present; a far more effective result would doubtless be obtained if we found a means of stopping the fibrillation, but, so far, all measures to this end have failed.

Tachycardia.—In all cases of tachycardia a search must be made for the cause, for treatment directed merely to the rapid heart action will certainly fail. If it can be attributed to the condition last mentioned

(auricular fibrillation), the treatment should follow that described. If it is due to some non-febrile state, such as occurs in neurotic people, then the treatment should be directed to the nervous system. In obscure cases the possibility of poison, particularly from alcohol or from tuberculous and malignant diseases, should be considered.

In febrile cases manifestly some cause is at work, and the consideration is directed to finding out whether the increased rate is due to an infection of the heart itself or is provoked by the increased temperature. It is useless in these cases to try and slow the heart's action with drugs that act upon the heart: the treatment should be directed to the febrile condition which induces the heart's rapid action.

A persistent tachycardia may arise from the heart's contraction starting from some place other than normal, and it is difficult to recognize this unless tracings of the jugular pulse are obtained, in which the usual sequence of events characteristic of the normal jugular pulse is no longer present, or by means of the electrocardiogram. If, with the persistent rapidity, there is also much prostration, it is imperative that the patient should have rest and be treated on the lines laid down for extreme heart failure. Except when this is due to auricular fibrillation, the prescription of remedies is most disappointing. In such cases I have pushed to the limit all sorts of drugs that we know to have an effect on the heart, and the only success I have obtained has been with digitalis in full doses, and steadily pushed until a physiological reaction was produced, and repeated if it fails to affect the heart in the first instance.

Paroxysmal Tachycardia.—There are a great number of very obscure conditions which provoke the heart temporarily to a greatly accelerated rate. There are cases in which the rate is increased from direct stimulation, as in response to effort, excitement, or indefinite causes, and in these the heart's chamber contracts in a normal manner. These may appropriately be called cases of palpitation, to distinguish them from cases of paroxysmal tachycardia. In late years, by means of the graphic records and the use of the electrocardiograph, we are able to recognize a number of cases, characterized by rapid action of the heart coming on suddenly, stopping suddenly, where the contraction arises in some place lower down in the auricle or ventricle, than the normal starting-place at the mouth of the superior vena cava.

The rates vary from 110 to 200 beats per minute; I have met with only one case with a rate of 300 beats per minute.

The patients are often conscious of the onset of the attack, and are perforce compelled to go about very quietly, and even to lie down while the attack lasts.

The treatment of these cases is one of the most difficult problems. The patients have frequently some expedient which they employ which stops the attack, as by bending down and taking a deep breath, by making themselves vomit, by taking a glass of raw brandy. Frequently these expedients fail, and the patient has to wait until the attack subsides of itself.

Many remedies have been suggested to stop these attacks, but I

have little hesitation in saying that no remedy has yet been found of any use. When they have ceased, after the employment of some remedy, it has been because the attack has spent itself, and the cessation has been independent of the remedy, and this view the patient will ultimately endorse. I think it well to insist upon this, for then we may be the more active in an inquiry into the nature of these attacks and a means to stop them.

While the attack is on, the patient instinctively himself seeks rest, and the quieter he is kept, the less exhausted does the heart become. If the attack persists for days and sleep cannot be obtained, then a sedative—chloral or a preparation of opium—should be given. If it is accompanied by dilatation of the heart and evidence of heart failure, as cyanosis and turgidity of the face and lips, enlargement of the liver, and dropsy, then the treatment should follow the lines laid down for extreme heart failure, drugs of the digitalis group pushed until a physiological reaction appears.

In spite of all treatment, the accelerated rate may cease to become paroxysmal and become continuous, and the patient may drift to a fatal issue.

There are often circumstances that in some cases seem to provoke attacks, as indigestion, constipation, errors in diet, effort, worry, sleeplessness, unpleasant dreams, and any of these should be carefully considered and treated. Among many remedies I have tried to prevent the attacks, bromide of ammonium is the only one I have found useful. Many patients do have fewer attacks when they are on the bromide, though it does not stop them altogether. I give it usually in doses of 20 gr., three times a day, for four or five days, then once or twice a day, being guided in its continuance by its effect upon the patient.

Heart-block (Adams-Stokes Syndrome).—The stimulus for contraction normally passes from the auricle to the ventricle, through the narrow bundle of muscle and nerve-fibres, called the auriculoventricular bundle. If this bundle be damaged, the transmission of the stimulus is hindered, so that there may occur a delay in the contraction of the ventricle, or the stimulus may fail to get through, and the ventricle misses a beat. This latter result may occur at rare intervals, or the ventricle may respond only to every second or third auricular contraction (partial block). Finally, the lesion may break through the bundle and prevent the transmission of all stimuli from auricle to ventricle, and the ventricle then contracts independently, with its own independent rhythm, which is usually about the rate of 30 beats per minute (complete block).

The slighter forms of partial block can be recognized only by means of graphic records. The more advanced forms of partial block and complete block can be recognized by the fact that the auricular pulsations in the jugular are more frequent than the ventricular contractions. When the ventricular rate falls under 30, it may safely be assumed that complete block is present.

The lesions causing the block are usually changes invading the bundle. In acute cases cellular deposits have been found. Syphilitic

gummata have also been found affecting the bundle and producing heart-block.

Usually no symptoms characteristic of this condition are produced, except it may be the too speedy exhaustion of the work-force of the heart, until complete heart-block sets in. When this occurs, the patient usually becomes easily exhausted, and in some, attacks of loss of consciousness, slight or prolonged, with convulsions (Adams-Stokes syndrome), may occur at intervals, more or less frequent. The immediate cause of these attacks is the slowing of the ventricular rate, to such a degree that anemia of the brain results in the loss of consciousness. The period of greatest liability to these attacks is the time when the block first becomes complete. In experiment it is found that when the auricle is separated from the ventricle, the ventricle may stand still for a period before it takes on its own rhythm. The same thing happens in heart-block, and in some patients periods of partial and complete block occur and at the beginning of the period of complete block these syncopal attacks are prone to appear. In rare cases, with complete heart-block, periods of slowing from undiscoverable causes occur, during which these attacks supervene and death may ensue.

It is only in cases where there is ground for suspecting a syphilitic lesion that treatment is of avail in removing the cause of the block. When there is a syphilitic history or a suspicion of it, a thorough anti-syphilitic treatment should be carried out. There are records of a few cases of recovery seemingly due to treatment of the syphilitic affection.

In regard to the milder forms of partial heart-block, the heart-block is not the factor which is the object of treatment, but such form of heart failure as may be present. It must, however, be considered in the application of treatment, for its presence may modify the action of drugs of the digitalis group. This kind of drug is not necessarily contraindicated, but its action should be carefully watched lest the block be increased, by its tendency to depress the conducting power of the auriculo-ventricular bundle (Fig. 19).

When the slowing of the ventricular rate is due to partial heart-block, drugs, such as atropine, have been used to paralyze the vagus, and in some instances the rate of the ventricle has for the time being been increased; but no permanent improvement can result from this line of treatment. I have also seen a two to one rhythm revert to the normal rhythm for a brief period on the administration of massive doses of oxygen.

To prevent the ventricle becoming too slow in its action, when there are intermitting periods of partial and complete heart-block, some drug which excites the ventricle should be given, but we have not yet found an efficient remedy. Cushny has suggested helleborein, and I have used it, but without effect, the dose ($\frac{1}{5}$ gr.) being probably too small. When the block is complete, and there is evidence of heart failure, dropsy, and exhaustion, drugs of the digitalis group may be safely employed, as they do not slow the ventricle when it is contracting in response to its own stimulus.

During these periods, when attacks are likely to supervene, the patient should be kept very quiet, in bed, or moving about very carefully. If fairly free from them, and it is necessary he should go about, he should always be attended by some one who is on the watch.

The slighter attacks of loss of consciousness are soon over and nothing need be done for them. During the severer attacks the patient should be laid in the recumbent position, and all obstruction to the free respiration removed. He should have plenty of fresh air, and, if feasible, oxygen in large quantities should be inhaled. As I have said, no remedy has been found that will excite the ventricle to greater activity, though many so-called cardiac excitants (strychnine, caffeine, spermine) have been tried. Injections of atropine may be tried, lest there be some overaction on the part of the vagus nerve.

Valvular Defects.—I have already pointed out that valvular affections should be considered only so far as they are indications of a progressive lesion affecting the heart and bloodvessels, or as they embarrass the heart in its work. When, therefore, we detect a valvular murmur, three points have to be considered: (1) Does the murmur indicate such a lesion of the valve that the heart is obstructed in its work? (2) does the presence of the murmur imply an active process going on in the heart? (3) has the lesion that has affected the valve also affected the muscle of the heart? The careful clinician will have little difficulty in determining these points, and naturally the treatment will be guided by the answers.

In regard to the first question, if we detect a murmur at any orifice, and we find the heart's power of response good and no evidence of exhaustion, then no treatment is called for, so far as the heart is concerned. If there be evidence of exhaustion, very careful discrimination should be made, to find out if the defect is really the cause, before treatment is especially directed to the heart. Many people have heart murmurs, and many people suffer from exhaustion from the many causes which arise in a strenuous life, and such exhaustion may often be independent of the valve defect, and in such cases the treatment should be directed toward restoring the patient's strength by means of other than special heart treatment. When, however, we find that undoubtedly the valve lesion has so obstructed the heart that exhaustion has resulted, then we have clear lines to follow. The exhaustion has in all probability come about in consequence of the individual endeavoring to keep up his work at the level of one with a sound heart, so that his handicapped heart ultimately gives out. The treatment then should follow the principles already laid down in describing the effects of rest and drugs.

If, in reply to the second question, it is found that the murmur implies active change, then perfect quiet and rest is imperative and every means adopted that will give the heart complete rest. If there be any fever or causative factor, then treatment should be specially directed to them.

The third question deals with what is called chronic valvular cases. The valvular murmur being such a dominating symptom to the physician, his attention is diverted from what is often the real factor in the

heart failure, namely, the condition of the heart muscle. It probably never happens that the lesion in chronic valvular affection, where there is severe heart failure, is limited to the valves alone, and certainly such heart failure is always accompanied by changes in the muscle, and this really constitutes the source of danger. The evidence of this muscle failure is manifested by changes in the size of the heart, in the movement of the heart, and in its rhythm and rate.

I have already dealt with alteration in the rhythm and the rate, and the indications for treatment in change of the heart muscle is dealt with in the next section.

Myocardial Affections (Dilatation, Hypertrophy, Degeneration).

—It is rare that we have to treat a heart affected by dilatation, or hypertrophy, or degeneration alone. Except in febrile conditions or in poisoning or in anemia, we rarely get dilatation without hypertrophy or degeneration.

When *dilatation* occurs in acute febrile affections of the heart, or as a result of some poison or malnutrition, generally all the cavities are affected simultaneously. This also happens when there is dilatation of the heart from most other causes, the whole heart gives way, as in advanced failure of old-standing rheumatic heart cases, and in auricular fibrillation.

The line of treatment of dilatation will be found to depend on the causes inducing it; thus in febrile affections the treatment is directed to the cause of the fever. In a series of cases I observed in Lancashire, during the time that the beer was contaminated with arsenic, I saw a number of beer-drinkers with extreme heart failure and dilatation. A number of hearts quickly regained their normal size on ceasing to drink the arsenic-contaminated beer. I have seen a number of rapidly fatal cases of heart failure presenting only symptoms of great dilatation, and, from their resemblance to the arsenical cases, I have supposed that some poison has affected the heart muscle. In all cases of dilatation with no history of old-standing heart trouble it is always well to inquire into a possible means of poisoning, and particularly of an alcoholic or bacterial source. Treatment should then be directed to the removal of the cause.

In simple dilatation from anemia, as in chlorosis, malaria, or malignant anemias, the treatment should be directed to the anemia. It may be well to state that treatment by the use of so-called "cardiac" drugs, as the digitalis groups, strychnine, carbonic-acid baths; will be so much waste of time in these cases. If the cause of the dilatation cannot be ascertained, far better to treat the patient in lines that will improve the health of the patient as a whole. Dilatation associated with old cardiac lesions—valvular or muscular—should be treated as part of the conditions in general failure of the heart, on the lines already laid down, by rest and digitalis if necessary. It is remarkable, however, how responsive to treatment the dilatation associated with chronic valvular disease is to the digitalis group of remedies.

Hypertrophy of the heart calls for no special treatment. When it

is physiological, in response to some healthy form of effort, it may be necessary to caution the individual against too long an indulgence of the effort. Otherwise, hypertrophy is an evidence of some inherent defect in the circulation, as in valvular disease, high blood-pressure, or arterial disease, and it is a sign for treatment to be directed to lessening the work of the heart, by making less calls on it, by modifying the daily life of the individual, and by removing the causes of high blood-pressure as far as possible.

When our attention is called to hypertrophy, it is generally associated with some more or less degenerative changes, and the hypertrophy is no longer able to maintain an efficient circulation; the patient's field of response has become so restricted that he is forced to seek advice. The symptoms presented may be very varied, and they give indication for special treatment, as angina pectoris, cardiac asthma, Cheyne-Stokes respiration, dropsy, etc., and under these headings certain directions are given. The general plan of treatment should, however, be carried out, as indicated in dealing with remedial measures.

Fatty degeneration of the heart cannot be diagnosed with certainty, but, where it is suspected, we should distinguish between a heart that is loaded with fat and where the fibres are degenerated. In the former case more vigorous exercise in the open air should be taken, and by dietetic means the amount of bodily fat reduced. When we suspect fatty degeneration, more care has to be exercised. If the patient has been taking little exercise, then exercise judiciously undertaken in the fresh air, gradually to train the heart, may do much to flush the heart with healthier blood, and reinvigorate such of the fibres as are not too far degenerated. Even in patients seemingly crippled the response to such treatment is surprising. Other measures to promote a healthy life should be prescribed.

Pericarditis and Pericardial Effusion.—Dry pericarditis gives rise to no subjective sensations, and is only detected by the characteristic friction sound. In many cases it requires no treatment, for the symptoms associated with it indicate some more serious condition which requires attention. Thus, in acute pericarditis there is often great increase in the size of the heart, but this increase is not due to the pericarditis, but to a myocardial affection, and it is to the consideration of the cause and cure of this myocardial affection that attention should be directed. (See *Acute Febrile Affections of the Heart*.) When we detect pericarditic friction in the course of a pneumonia or Bright's disease, the treatment is, in like manner, directed in the main to these other conditions. Incidentally, the pericarditis may be treated by blistering or leeches. Pericardial effusion generally disappears by itself, but if it persists, then blistering should be tried, with the administration of iodide of potassium and an occasional mercurial pill. Failing this, the pericardium should be tapped, the safest place for inserting the needle being the fifth interspace in the nipple-line. Care must be taken to make sure the diagnosis is quite right. Should pus be found on tapping, it is best at once to incise the pericardium and drain it.

Adherent Pericardium.—No characteristic symptoms are produced by adherent pericardium unless the adhesions extend beyond the pericardium, and become attached to some more or less unyielding structures, as the spinal column or ribs. When this happens, the heart is greatly embarrassed and grievous symptoms of heart failure ultimately appear. The treatment of these cases of adhesive mediastinitis should follow the lines laid down for treating extreme heart failure, but, as a rule, the result is extremely unsatisfactory. Some cases seem to have attained at least temporary benefit from resection of a portion of a few ribs (Brauer).

Acute Febrile Affections of the Heart.—In considering acute infections, or febrile affections, of the heart, it is best to consider the condition of the heart as a whole, and not to divide the affections into endocarditic, myocarditic, or pericarditic affections. In doing this, we shall appreciate the importance of symptoms and view them in their proper perspective—on the one hand, not unnecessarily alarmed by the presence of a murmur, nor lulled into false security by its absence. In this connection it is necessary to bear in mind that, murmur or no murmur, friction sound or no friction sound, an increased size of the heart means a myocardial affection, and that affection of the myocardium is in many cases a graver condition than the endocarditis or pericarditis which may happen to be present. It is necessary, therefore, that, in all acute affections of the heart, the size of the heart should be carefully watched.

Acute febrile affections of the heart are due to the invasion of the heart by some microbe. Rheumatic affections are by far the most common cause, though the specific organism of erysipelas, pneumonia, diphtheria, and other infectious complaints may invade the heart.

In addition to the treatment directed to the specific fever, with which the body is assailed, the heart condition should be carefully watched, the body should be kept at rest and made comfortable, sleep should, if possible, be insured, and careful attention paid to the digestive system, the mouth cleansed, food given in small quantities, and, when possible, well chewed, so as to keep the mouth clean and prevent flatulent distention. The bowels should also be carefully regulated.

In the febrile stage drugs such as digitalis are of no use and should be withheld. There is usually no indication against pushing the salicylates in rheumatic fever, especially as there seems more reason to expect that its beneficent action in rheumatic fever may be by acting on the specific cause of the fever, whether located in the joints or in the heart.

It is impossible to tell in many cases whether the heart itself is invaded by the microbe producing the fever, nor do the symptoms present, as a rule, help the conclusion. It is necessary, therefore, to bear in mind that, apart from such definite signs as are caused by emboli or pericardial friction, the heart in the febrile state may become dilated, increase in rate, and show murmurs, with no invasion of the heart by any specific organism, the rise in temperature apparently being sufficient to produce these symptoms. This has to be considered when the ques-

tion of after-treatment arises, for the heart quickly recovers when it is merely affected by the febrile state. When, however, we are convinced that the heart has been invaded by a disease process, as after rheumatic fever, then the patient should be kept quiet for a long time after all the febrile symptoms have disappeared. It may be months before the heart muscle has recovered, and if exercised before the inflammatory changes have disappeared, permanent enfeeblement of the heart may follow. The subsidence of the dilatation and the gradual return of the work-force will be the best indication when restrictions should be relaxed. In addition to the treatment of the heart by rest, treatment directed to the improvement of the patient's general health should be carried out.

The treatment of malignant infective endocarditis is most discouraging. Our drugs and methods are unavailing, and, while vaccine or serum therapy holds out the prospect of a remedy suitable to each infection, so far it has been proved practically powerless to stay the progress of this form of disease. On this subject all who have had experience are agreed. All forms of reputed remedies—cardiac drugs, “blood antiseptics,” vaccines, yeast—have been tried in vain. The only thing that the physician can do so far is to place the heart in circumstances that will render its work as easy as possible, by attending to the patient's comfort and regulating his food, sleep, and affairs in general.

Dropsy.—One of the most striking symptoms in heart failure is “dropsy.” Without dealing with the many speculative views concerning the mechanism by which dropsy and edema are produced, we may take it that it is an evidence of heart failure, that is, when it is not occasioned by some other cause, as kidney disease, mechanical obstruction. Usually it is accompanied by a diminution of the amount of urine, and it may be taken that there is a connection between the two circumstances, and that the method of getting rid of the dropsy is to increase the efficiency of the circulation and the flow of urine.

In the earlier stages of its appearance it may be found that the heart is not able to respond to effort, and, at the same time, to carry on an efficient circulation, and dropsy may appear. With the easing of the heart's work the dropsy disappears. This may be obtained by diminishing the amount of work, as by rest in bed, or even by reducing the body weight in fat people. With persistence of the dropsy, notwithstanding these milder efforts, the employment of the drugs of the digitalis group is often followed by marked disappearance of the dropsy, either when given alone or combined with other drugs, as the calomel and squill and digitalis pill. When the dropsy refuses to yield to this line of treatment, restriction of the amount of fluids should be tried. A stage is ultimately reached when remedies are of no avail, notwithstanding that many forms of treatment are especially lauded in their action on dropsy. In some cases the elimination of common salt from the diet seems to do good, and in others drugs, as diuretin or theocin-sodium acetate, seem to help when other remedies fail. But dropsy is occasionally very variable in its response to treatment, at one time yielding to almost any kind of treatment, at another, most resistant, until

a certain stage is reached, or until certain unknown circumstances occur, when it will suddenly yield to some very mild treatment, or even when no special treatment has been employed. Thus a patient may lie for weeks dropsical, and the heart weakness extreme and unyielding to all forms of treatment, so that special treatment may be suspended. After a time the urine will begin to flow, and the dropsy gradually disappears and the patient makes a permanent recovery. A mere change in the position may have the same effect on the dropsy. I have seen a patient, who has had to sit up in a chair for three weeks on account of his breathing, become extremely dropsical and pass very little urine. The return to bed was followed at once by a profuse diuresis and the rapid disappearance of all the dropsy.

It is because of this tendency of dropsy to suddenly disappear with the aid of some stimulus that the wonderful results are attributed to certain drugs or methods of treatment.

In all cases the bowels should be kept freely moved if the patient's strength permits.

Stages are, however, reached when nothing seems to help, so that special efforts to give relief have to be resorted to. In certain cases, where the patient can go about, an elastic bandage, skilfully applied, is beneficial, particularly in those hard, swollen legs where the skin threatens to give way. Massage is also of assistance. When the legs or genitals become greatly swollen, deep pricks with a needle will often be followed by a free flow of serum and a great diminution of the swelling. The utmost cleanliness should be observed in carrying out this simple procedure. The employment of Southey's tubes, inserted in the legs or abdominal wall, will often drain off a large quantity of the fluid. The abdominal and thoracic cavities may need to be tapped; such tapping invariably gives temporary relief. In some advanced cases, when the penis is greatly swollen (ram's horn), there may be inability to void urine. In using a catheter there may be some trouble in finding the meatus, the glans penis being buried in the scrotum and the greatly distended prepuce. If the swollen foreskin be gently but firmly grasped in the hand and compressed, the fluid is driven out and the glans can then be exposed.

The employment of judicious breathing exercises in edema of the lung is often beneficial, the patient sitting up and breathing slowly and deeply. In severe cases this is limited at first to a few movements. If the patient bears the exercise, these deep respirations should be employed at regular intervals every two or three hours when awake. In the intervals the patient should be propped as high as he can bear with comfort.

TREATMENT OF SUBJECTIVE PHENOMENA

So far I have been discussing the treatment of symptoms observed by the physician, and it is necessary to consider the subjective sensations of the patient as a guide to treatment. I have already pointed out that our knowledge of the extent of heart failure is best attained, in the

majority of cases, by recognizing the nature of the patient's sensations. There are a number of sensations of such a characteristic type that they offer good grounds for the application of treatment suitable for the condition that calls them into being. Under this heading I propose to discuss the treatment of angina pectoris and other sensations induced by the heart, which are usually included under the term "neuroses."

Consciousness of Heart Trouble.—The consciousness of heart trouble has often a depressing effect on people, whether the trouble be slight or serious. When such people become convinced that the trouble is curable and not serious, their condition at once becomes greatly improved. Cures by faith, whether in drugs, baths, elaborate methods, or religion, act by playing upon the mental condition. We should always study the mental condition of the patient and its bearing upon his complaint, and we should utilize its peculiar features in treatment. But our employment of this element in treatment should not be the outcome of blind, unreasoning faith in some rite or ceremony, bath, or drug, but in the intelligent perception of the nature of the symptom. The reassurance of the patient of the harmless nature of the complaint goes a long way toward curing him. When there is some affection that cripples him, the reassurance that, with reasonable care, no danger need be feared, is extremely helpful. Even in serious cases, when there is reasonable hope of recovery or a certain degree of recovery, the encouragement of the patient may and does help forward his improvement. The mental factor, on the other hand, should make us very chary of giving a gloomy prognosis. There is nothing in my experience so surprising as the manner in which the heart can recover from the seemingly most hopeless condition of exhaustion; and we must bear in mind that a gloomy view may in itself nullify the best attempts at treatment. We should aim at getting the patient into a placid, contented, hopeful frame of mind, so that the heart is not disturbed by emotional reflexes.

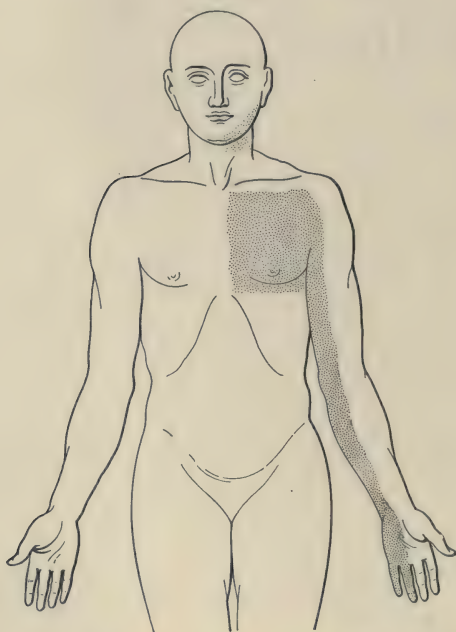
Angina Pectoris.—For the purpose of finding a rational therapy I include under this section all forms of pain and discomfort, such as constriction of the chest, sense of suffocation, sense of impending death, which have their cause in some cardiac condition. The pain when present is usually recognized as being of cardiac origin, when it is restricted to some part of the region of the peripheral distribution of the spinal nerves, whose centres in the cord are in close association with the sympathetic nerves supplying the heart, namely, the two lower cervical and the upper four dorsal nerves, usually on the left side. This area embraces the chest and the inner side of the upper arm, ulnar border of the forearm, and hand. Sometimes the pain may be felt in the neck and jaw (*i. e.*, the peripheral distribution of the upper cervical nerves, probably in association with the vagus centre) (Fig. 27).

Taking these symptoms as a basis, we find they always occur in association with the exhaustion of the heart muscle, whatever may have been the conditions that have led to this exhaustion. It is, in my opinion, of importance to recognize this relation between angina and exhaustion, for we are at once given a safe guide to treatment, the practical

indications being to restore the exhausted muscle and prevent its recurrence.

But, before dealing more fully with the treatment, there is another factor involved, which is also of prime importance, viz., the nervous system. From a variety of unknown causes some people seem to have pain more readily provoked than others, as is seen by the fact that lesions, seemingly identical, give rise to different nervous phenomena in different people. Moreover, as a matter of experience, not only may pain be more readily produced in some people than in others, but, when

FIG. 27.



The shaded areas show the regions in some part of which pain of cardiac origin is usually perceived. Occasionally the pain may be felt in similar areas on the right side.

once a tendency to attacks of pain is established, the attacks become more easily provoked. The recognition of this helps us in two ways, first in recognizing the fact that the severity of the pain is no guide to the gravity of the lesion, secondly, treatment directed to the nervous system may be of far more benefit than when directed to an evident cardiac lesion. It behooves us, then, in any given case to consider the causes of exhaustion and the part played by the nervous system.

To find out the best means of treatment we seek for the cause of exhaustion. This is, as a rule, not a difficult matter, and here I illustrate the manner in which this may be done,

The most common forms of angina appear between the ages of fifty-two and sixty-five, and in these cases we have to consider what may have induced the exhaustion. We know that in many people at this time of life changes have taken place in the circulatory apparatus, which are due to advancing years, aggravated, it may be, by the kind of life that has been followed. We, therefore, carefully inquire into the life history, and may likely find that the patient has been leading a strenuous life for a great many years, doing as much as in the prime of health, thrusting from him the indications that told him the signs of heart exhaustion, for if careful inquiries be made, some symptoms of discomfort, as a slight tightness across the chest or breathlessness, have appeared at intervals long before the onset of the pain which forced him to seek advice. Manifestly here then the exhaustion has come through a long-continued strain, and the possibilities are that, some relief being given, the heart will regain its strength and the distressing phenomena disappear. In such cases it is not necessary to stop a business-man from doing all his work. To do so may affect his circumstances most seriously, and his business affairs may be unnecessarily jeopardized. It may be quite sufficient for him to omit some of his less pressing duties, and the relief thus obtained may be quite sufficient.

As a rule, it is best for him so to arrange his affairs that he can take a restful holiday with his mind at ease. The holiday should be spent in that manner which affords the maximum of enjoyment with the minimum of effort. If the patient has no particular bent, and if a holiday might drag wearily, he may be sent to some watering-place, and made to undergo the régime peculiar to that place. The carrying out of the directions gives his mind sufficient exercise to prevent tedium, and he will have the opportunity of reaping the benefit that the waters may possess. In all cases the mode of living must be considered, and the habits of the individual, so that errors in diet, abuse of alcohol or tobacco, should be corrected. There may be some defect in the heart, a murmur (an aortic systolic murmur is very frequent), or what is thought to be a high blood-pressure or thickened arteries is detected. While noting such conditions, treatment should not be directed to their amendment alone, for they are but individual features of a very complex condition.

In cases that do not benefit from such limited restrictions, and when the attacks are demonstrably the outcome of an advanced exhaustion of the heart, then more rest is required, until, in extreme cases, it is necessary to confine the patient to bed. In the more extreme cases strict attention should be paid to the amount and kind of food, the state of the bowels, freedom from annoyance and worry, and a sufficient amount of sleep should be ensured.

It is only in rare cases that, in spite of this line of treatment, the patient gets worse, the attacks recur, and the patient finally succumbs. This resistance to treatment is an important element in diagnosis, for it will invariably be found that the lesion that has induced the attacks of angina is of such an advanced nature that it rendered the heart unfit to maintain a circulation compatible with life. In such cases, when,

notwithstanding plenty of rest and the correction of any errors in diet, no progress is made, the attacks supervening on the slightest exertion, we must recognize that we have to do with an exhaustion so extreme that its cause may be due to organic changes in the bloodvessels of the heart and the heart muscle, that no prospect of recovery can be entertained. Under these circumstances the patient must be kept at complete rest, his food and his habits carefully regulated, and all circumstances likely to induce the attacks of angina avoided, while sedatives, such as chloral or opium, may have to be administered to prevent the occurrence of the attacks or to lessen their frequency.

But, before coming to the conclusion that the heart condition is irremediable, we must weigh carefully the possibility of the attacks being more readily provoked in consequence of an exalted susceptibility of the nervous system. In many cases, where the slightest exertion, such as getting out of bed, walking across the floor, may induce an attack, if careful inquiry be made, the patient may have passed through a period of stress, worry, or anxiety, and may have had sleepless nights. If such patients are protected from their worries and acquire peaceful and restful nights' sleep, recovery may at once set in and proceed to a surprising extent. Even when there is advanced degenerative changes in the heart and bloodvessels, this is found to be the case. The most useful remedy I have found in these cases is bromide of ammonium, given in doses of 20 gr., thrice daily, until a certain degree of lethargy and drowsiness is produced. This remedy acts not only in inducing sleep, but in rendering the individual more indifferent to the worries and troubles that beset him. In some cases there are periods when the attacks of angina are liable to recur, and these are preceded by sleepless nights. The administration of the bromide when the sleeplessness first appears may prevent the exhaustion which induces the anginal attacks.

There are a great many conditions in which attacks of angina are liable to occur, which are induced by factors which weaken the heart or the nervous system, so that the latter becomes unduly sensitive. Thus overworked women, particularly about the menopause, frequently have attacks of pain of undoubted cardiac origin. Ill-nourished and anemic people are liable to attacks, particularly if they are subjected to long and exhausting hours of labor or with disturbed nights, as in nursing the sick. The treatment in those cases so obviously demands rest and nourishment that it is unnecessary to dwell upon it further. In many of these cases, where there is manifest nerve exhaustion, the bromides will prove valuable aids. In its effects it may produce listlessness and a feeling of greater weakness, but this is no indication for its discontinuance, as the heart is being protected from exertion, and will ultimately regain some strength because of the enforced idleness.

There is a class of patients who are readily susceptible to influences which affect the circulation, especially to cold, and some are liable to attacks of angina pectoris. These attacks are more frequent or occur entirely during winter. Others are peculiarly sensitive to certain articles, such as tobacco, coffee, and they usually appreciate the fact that over

indulgence provokes a liability to attacks of pain of cardiac origin. The majority of these patients are of a somewhat characteristic type, spare in body, the fingers liable to become cold and their noses red, sometimes there is dilatation of the stomach and some slight dilatation of the heart, they are somewhat neurotic, a class I have included elsewhere under the title "X disease," a provisional name, to describe a condition whose nature I do not understand. These patients require individual consideration; the treatment obviously depends on such circumstances as are applicable to each case, a sensible regulation, in fact, of the patient's mode of life. So far as the heart is concerned, the attacks of pain are not of a grave character, and treatment should be directed to getting the heart into a good tonic condition by suitable exercises in the open air. The indications are not for resting the heart, but for improving its tone by training and judicious exercise of its functions and avoidance of conditions which bring on the pain.

In elderly patients, showing a tendency to angina pectoris, in addition to the regulation of the patient's mode of life and the removal of any accompanying ailment, such as indigestion, kidney trouble, some medicinal measures are sometimes of avail. Thus, iodide of potassium is usually recommended in those with firm pulses and thickened arteries, and particularly if there is a history of syphilis. Some recommend large doses, but I seem to have had good results, which were obtained by doses of 5 gr. thrice daily. The remedy should be given intermittently, as for one week every month. In many people tonics, as quinine, *nux vomica*, will help the general health.

A very important factor in treating cases with angina pectoris, as well as all forms of neurotic hearts, is the mental condition. The fact that patients who suffer from angina pectoris sometimes die suddenly, or die shortly after the appearance of the symptoms, has so impressed the lay mind as well as the medical that a very gloomy view of the condition is taken. As a matter of experience, it is only a very small proportion of the cases, even of those with severe attacks, in which there is cause for immediate concern. The vast majority of patients can recover to a very great extent, and lead useful lives for indefinite periods. Therefore, it behooves us to make a special study of each case, and when we find the condition is of no gravity, a favorable prognosis, given with an air of conviction, will at once do a great deal of good. This element of hope must be based upon a clear conception of the heart's condition, and the careful physician will have little difficulty in detecting the essential features in each case.

In certain cases, where there is aortic valve disease, attacks of angina pectoris are easily provoked, and the patient's life must be greatly restricted on this account. These attacks may appear in patients between thirty and forty, where the valve disease was due to rheumatism or syphilis, as well as in the elderly, where the lesion may be due to fibrous degeneration. So severe may these attacks be, and so easily provoked, that the patients are forced to lie abed. In such cases relief may be obtained by pushing the bromides ($1\frac{1}{2}$ to 2 drams a day) until a condition of lethargy

is produced and the patient lies in a drowsy condition. After a few weeks, if the patient is allowed to come out of the influence of the medicine, a distinct improvement in his condition may be found. Otherwise this kind of patient is one of the most difficult to treat, and liable to become addicted to the opium habit when opiates are resorted to for relief. The great suffering is consistent with a long life, and I have watched cases of this sort for twenty years.

Treatment During Attacks.—The slighter attacks require no treatment. When they become more severe, rapidly acting vasodilators should be administered, such as hot drinks, hot water with whisky or brandy, and, best of all and most speedy, amyl nitrite by inhalation or nitroglycerine. The nitrites are not successful in all cases, but their action is rapid, and the relief is generally complete. When it is successful, it is inferred that the patient has previously had constricted arterioles or increased arterial pressure, and that the pressure was reduced and the heart was eased. This is not the full explanation. A patient with *cardiosclerosis* had an attack of *angina pectoris* in my consulting-room. I took his blood-pressure, and found it 190 mm. Hg, and then administered to him nitrite of amyl; it acted instantaneously and gave him perfect relief. After fifteen minutes I again took his blood-pressure, and found that it had risen to 200 mm. Hg. Though the pressure was higher, he had no pain.

Oxygen inhaled during an attack may give relief. When the nitrites fail to relieve the patient, we are forced to use chloroform, chloral, or morphine in doses sufficient to give relief. I have occasionally found that chloral acts beneficially, not only in relieving the somewhat long attacks, but in preventing the attacks recurring, particularly when given at night to induce sound sleep.

Palpitation and other Neuroses.—There are a number of cardiac conditions which act upon the conscious nervous system (mental and physical), and a number of nervous conditions that react upon the heart, and these may, for want of a better term, be called “neuroses of the heart,” though no strict definition of the term can be given. I have already drawn attention to the fact that, in some people with an abnormally sensitive nervous system, an extrasystole or an attack of tachycardia produces distressing effects. Such conditions are sometimes spoken of as “nervous,” but we must recognize them as cardiac defects, apart altogether from the nervous symptoms they produce. On the other hand, there are cardiac symptoms distinctly attributable to neurotic conditions, and of these, what is generally described as palpitation is the most common. “Palpitation,” in the sense used here, may be described as the sensation by which the patient is conscious of the forcible or excited heart’s action and usually with increased rate. In this action of the heart the stimulus for contraction arises at the normal place, whereas in paroxysmal tachycardia the stimulus for contraction arises at some place other than the normal. Moreover, palpitation is usually induced by some stimulus reaching it by its sympathetic nerve-supply, as from mental emotion or digestive disturbance. This ten-

dency to attacks of palpitation bespeaks an excitable condition of the heart, chiefly in its regulating mechanism. From this it will be seen that the treatment must be based on two principles, the removal or avoidance of any causal conditions, and the dulling of the susceptibility of the nervous mechanism of the heart. The mental state of the patient must also be considered and the condition of his bodily health. If the patient is easily upset or startled, as far as possible circumstances producing this effect are to be avoided. The bodily health may be impaired, as in some forms of anemia, and treatment should be directed with the object of restoring any defect in the general health. Here it may be well to remark that palpitation may be an early sign of the premature exhaustion of the work-force of the heart, and the question of some real affection of the heart has to be considered. After dealing with the general health, it may be necessary to treat the nervous excitable mechanism, and this can best be done by sedatives, and particularly the bromides, these being pushed until some mental dulness is produced. In very distressing cases, especially where the attacks come on in the night, more powerful sedatives may have to be employed, such as veronal, sulphonal, and even chloral or opium. These drugs, however, should be carefully watched, and only used in cases of extreme need, and stopped as soon as possible, lest a drug habit be created.

During an attack it may be necessary to give some immediate relief, and the most speedy means is by some hot drinks, hot coffee often being helpful and comforting; brandy often gives great relief, but this must be used very rarely, as the tendency to repeated use becomes overpowering in some people, ending sometimes with the creation of the alcoholic habit. Other measures may be employed, as a hot India-rubber bottle to the chest or hot cloths over the heart.

Other forms of obscure conditions, partly nervous and partly circulatory, are met with, as in attacks of depression, weakness, faintness, and even syncope. In many the immediate cause is the deficient supply of blood to the brain, and they are quickly restored if laid in the recumbent position. It seems in some people that there is a tendency for the blood to accumulate in the abdominal cavity, and I have found on a few occasions remarkable improvement follow the wearing of a broad abdominal belt rather tightly applied. Some women feel faint if they stand too long, or if standing at the looking-glass dressing their hair their arms are kept elevated too long, and it is possible these positions in particular favor the accumulation of blood to the abdominal veins.

Cardiac Asthma.—A form of respiratory distress which comes on usually in the night, sometimes arousing the patient from sleep, has received the name of cardiac asthma. The kind of patient that suffers from this complaint is the elderly, and those who suffer from sclerotic degeneration of the heart muscle, often in those who, in addition, have chronic kidney trouble and high blood-pressure. Relief can often be obtained at first by careful attention to the patient's meals, attention to the bowels, and getting him to lie with his shoulders well raised. If attacks keep recurring, a small dose of chloral or opium on going to bed

may prevent the attacks. When the attacks are severe, and do not yield to such preventive treatment, various remedies may have to be tried. When the attacks last for over an hour, some experience great relief by small doses of chloral and opium. In a few cases I have found great benefit from massive doses of oxygen. Even given as a preventive, I have found oxygen of use, inhaled before going to bed. In all cases where it has been of benefit there has been some degree of cyanosis.

It need scarcely be added that the appearance of cardiac asthma is often the sign of an unyielding failure of the heart, and is thus of grave prognostic significance.

Cheyne-Stokes respiration usually calls for no treatment, but in rare cases, during the apnoëic stage, the patient may be roused by a terrible sense of suffocation. In these cases the end is approaching; oxygen and fair doses of morphine or chloral generally afford relief.

HIGH BLOOD-PRESSURE

It might with justice be urged that, as high blood-pressure is the outcome of a number of factors, treatment should be directed to the removal of these factors, and not to what is, after all, a mere evidence of their presence. But so much has been said of late years about blood-pressure that a large number of the medical profession look upon it for practical purposes as a disease in itself, and methods of reducing blood-pressure are recommended on all hands. It is true that some of them proceed by a process of reasoning, whereby some factor is assumed to be the cause of the high blood-pressure, and the treatment is directed to the treatment of the causes. But it cannot be too strongly insisted upon that we know little or nothing of the causes of high blood-pressure, and a course of treatment, based upon what is thought to be physiological, as by administering vasodilators, is merely attempting to relieve a symptom, and will be found ineffective in practice.

Long observations of individual patients has shown me that blood-pressure can vary in individual cases in a very striking manner, and that, apart from treatment of any sort, while the numerous methods recommended for the reduction of blood-pressure are seldom effectual.

In all cases high blood-pressure should be looked upon as an evidence of some condition affecting the blood and its vessels. It must not be assumed to be in itself a sign of evil, for it is undoubtedly in some cases an evidence of the presence of a protective mechanism.

Treatment should in all cases depend upon the result of the careful examination of the patient, and the special circumstances in each case will give a clue to the line to pursue.

Arterial Degeneration.—Before considering the treatment of degenerative changes in the bloodvessels it is well to consider the causes that may have induced these changes and the peculiarities in their distribution.

To take the latter condition first, it will be found that the symptoms associated with, or due to such a condition as arteriosclerosis, depend

on the region where it may be most advanced. Thus, in some people it is the degenerative arteries in the brain which provoke the symptoms, and these symptoms are due to some impaired cerebral function. In like manner, we may have impairment of functions in the other organs, as in the heart, with its train of symptoms due to diminished work-power; in the kidneys, with the symptoms of Bright's disease; in the legs, with symptoms of intermittent claudication or gangrene, etc. Moreover, associated with the arterial degeneration are changes, usually of a fibrotic nature, in the organs affected, and these naturally impair the functional activity of the organ.

The need for bearing these facts in mind is shown when treatment is contemplated. By the time we are called on to consider the treatment the condition has reached an advanced stage, and has been accompanied by material changes in the bloodvessels and in the organs, so that it is useless to attempt to restore a degenerated artery or organ to their pristine state. Yet simple and self-evident as this proposition may seem, there are writers who actually assert that such a view is too pessimistic, and that they can restore a damaged artery. It is a manifestly absurd statement, but, unfortunately, it needs pointing out, for a line of treatment prompted with such a fantastic idea leads to a failure to recognize what is best to be done and a consequent serious loss of time. When we recognize our limitations, we shall cease to waste time in a hopeless quest, but apply ourselves to make the best with the irremediable conditions.

The line of treatment to pursue is to find out any possible cause which has produced the degeneration, and we may detect sometimes a history of syphilis, of gout, of hard work, or of kidney disease. Concerning this last condition, it will be found, I think, that, while long-standing kidney disease is accompanied by, and doubtless produces, the arterial degeneration, yet in many cases the kidney disease is itself an outcome of the arterial disease. Excessive use of alcohol or food are sometimes cited as causes, but, in watching my bibulous and gluttonous patients, and comparing them with the abstemious ones, I can't say I am convinced of these causes.

When we are consulted because of symptoms that point to the fact that degenerative arteries and the accompanying changes in the organs are at fault, the immediate cause of the symptoms will almost invariably be due to an inefficient supply of blood to the organ, as giddiness, loss of memory, impaired mental power when the symptoms are more exclusively cerebral, shortness of breath and angina pectoris when the symptoms are exclusively cardiac. When, therefore, we treat symptoms due to arteriosclerosis, the supply of blood to the part should, if possible, be increased. As this is, however, scarcely feasible by directly enlarging the capacity of sclerosed arteries, we must adopt other means. The chief of these means is to avoid overexertion of the part. The organ gives rise to no sign until exhaustion sets in, and this is not necessarily due to one special effort, but is the outcome of a long process of slight exhaustion, during which the blood-supply during effort has not only been deficient, but the period of rest has not been long enough to allow the restoration

of such strength as the organ is capable of acquiring. This view is illustrated by what I have said on heart failure; it can also be recognized in cases with arteriosclerosis of the cerebral arteries, and of the arteries of the leg when there is intermittent claudication. Therefore, at the outset the organ implicated should be given a sufficient rest, the directions to depend on the degree of exhaustion and the rate at which recovery takes place, after the manner described in the treatment of angina pectoris.

The patient's mode of living should be overhauled, and directions as to food and exercise given, which may eliminate any strain thrown upon the arterial system. Many of these patients are accustomed to visit various watering places, and experience benefit from the sojourn there. One can understand how a man, as years advance and senile changes imperceptibly develop, including arteriosclerosis, finds benefit from a complete change of his manner of life and enforced rest. An observing practitioner cannot but be struck that this improvement occurs in people who have sought improvement in a great variety of ways, in visiting the numerous spas, seaside or mountain resorts, or a holiday spent playing golf, yachting, or shooting; so that, when any particular place is specially vaunted as beneficial in arteriosclerosis, a healthy skepticism should be inspired regarding its virtues. It happens that frequently the physician is called upon to recommend a holiday in cases showing arteriosclerosis, and if he studies his patient, his tastes, and his strength, he can usually select some one of the numerous methods suited to the patient's condition and his purse. If he is sent to some watering-place, the régime and the waters or baths in vogue there may be followed. A beneficial effect may be obtained for his bodily complaints and the complete change may have a good mental effect.

Of remedies supposed to have a good effect, iodide of potassium is the one most frequently recommended.

Aneurism.—An aneurism, being due to a defect in the arterial wall, its course is usually one of progressive extension, with pressure on the surrounding structures. The symptoms provoked vary according to its situation and the nature of the structures pressed upon. Moreover, in many cases the aneurism is but a sign of a more general condition, and the symptoms present may be due to lesions of other organs, but these may be misunderstood or overlooked because of the presence of a well-marked aneurism. Thus, in many cases of aneurism of the aorta the degenerative changes have also affected the arteries, muscles, and valves of the heart, and the most serious symptoms may arise from this source. In the treatment of aneurism all these circumstances must be taken into consideration. The arterial lesion is, in the majority of cases, syphilitic in origin, and it seems that a life of strenuous physical effort and alcoholism plays a part also in its production, especially in syphilitic people.

It is manifest, therefore, that a certain number might be prevented by thorough antisymphilitic treatment after the infection. When, however, the aneurism has appeared, appropriate treatment is fairly well

indicated. The great aim is to prevent the extension of the aneurism by strengthening the walls of the sac. The aim of treatment in the case of the peripheral arteries, established by John Hunter, was the obliteration of all arteries leading to the aneurism, an aim arrived at by compression or by ligation. In the case of the more central arteries, like the subclavian and innominate, this method can only be employed with great difficulty, while, of course, it is out of the question with regard to the great vascular trunks.

In the treatment of aneurism affecting the aorta the attempt has to be made to close or strengthen the walls while leaving the arterial channel free. This is done by favoring the formation of a clot in the interior of the sac. As movement retards the formation of the clot, attempts are made to reduce the arterial flow from the heart. For this purpose the heart is kept as quiet as possible by bodily rest and the avoidance of all effort as far as possible. When there is reason to believe that the aneurism is growing, absolute rest in bed is imperative. In addition to rest, there should be a restriction in the amount of food to be taken. In early cases of the saccular form of aneurism, where it is progressive, the restriction should be fairly severe, even to the extent recommended by Tufnell—10 ounces of solid food and 8 ounces of fluid. This limited diet and perfect quiet will result in a great decrease in the number and force of heart-beats. Few patients can stand this very irksome treatment for long, but if carried out for some weeks, then gradually relaxed, much good may result. In many cases of thoracic aneurism, with visible swelling and pulsation of the chest-wall, the aneurism recedes in a striking manner with rest and a limited restriction of food, such as can be easily borne. In other cases it is not always possible to apply this treatment, or it has been of little avail, and many individuals have pursued a useful and moderately active life for many years with aneurisms of very considerable size.

Of late years clotting has been thought to be favored by the administration of lime salts. The drug, however, which has the greatest reputation in aneurism is iodide of potassium. It is supposed to act in a variety of ways, in healing the vessel-wall, in favoring coagulation, and in lowering the pressure. It is also strongly recommended for the relief of pain. Although many recommend its use, it is mainly through Balfour's whole-hearted advocacy that it has attained so wide a reputation. In recommending the employment of the iodide of potassium, Balfour points out that each case must proceed by way of experiment, in order to find out how the patient reacts to the treatment. The patient is put to bed for a few days without further treatment, the pulse-rate being noted night and morning. "So soon as the average pulse-rate in recumbency is accurately ascertained, 2 gr. of potassium iodide are given every eight hours, and, if the pulse-rate remains unchanged, the dose of iodide may be increased up to 15 gr. or more every eight hours, raising it by 1 gr. each dose until the pulse-rate begins to rise. It is only rarely that we can increase the dose beyond 10 gr. without this taking place. When the pulse-rate begins to rise, the iodide is stopped for one or two

days, and then we go back to the highest dose that did not raise the pulse-rate and continue that dose." Balfour maintains that not only does this method of treatment hasten the cure of the aneurism, but it is of the very greatest service in causing the cessation of pain. Although few observers are so enthusiastic about their results as Balfour, yet most assert that very considerable relief from pain may be obtained. In some cases there is intolerance of the iodide and it may have to be given up.

The more distressing symptoms of aneurism being due to pressure, the treatment that reduces the size of the aneurism naturally gives relief from them. Of these symptoms, however, pain is sometimes so severe and so constant that special treatment may be called for. It is not clear to my mind what the real mechanism of the pain is in many cases of aneurism. It is quite easy to say it is due to pressure on a sensory nerve or erosion of tissues, but in many cases, if carefully inquired into, the pain will be found to be referred to some region distant from the aneurism, and, in not a few, the region will be that in which the heart pain is usually felt (Fig. 9). In such cases I am certain that the pain is not then aneurismal in origin, but cardiac, and the treatment used should be then that indicated in cardiac pain.

For the continuous boring pain of aneurism, the iodide of potassium should be carefully pushed, as already indicated, but in some cases it is necessary to resort to the careful administration of opiates.

The hastening of the formation of the clot has been attempted by various surgical measures. They consist mainly of the introduction into the sac of some foreign body—which is left there, or by scratching the interior of the sac with a needle. Electrolysis has also been recommended, and this combined with the introduction of many feet of wire (iron and gold) into the interior of the sac. For all these methods an occasional good result is claimed, but the factors present in many cases are not capable of being fully appreciated, and, as cases partially recover with no special treatment, it cannot yet be determined satisfactorily how far such surgical treatment has been successful.

DISEASES OF THE BLOOD AND BLOOD-MAKING ORGANS

By J. C. DA COSTA, JR., M.D.

SYMPTOMATIC SECONDARY ANEMIA.

FROM a clinical viewpoint, it is convenient, in the present state of our knowledge, to group and designate by the term secondary, or symptomatic, anemia certain varieties of blood deterioration referable to some sufficient exciting cause, the removal of which, supplemented by the proper use of hematinics and food, brings about prompt regeneration of the blood along normal lines. Anemias belonging to this class are provoked by numerous different factors, but in all of them it is generally possible to single out hemorrhage, malnutrition, or toxemia, alone or in combination, as the essential underlying causes of the blood changes. This clinical classification, therefore, excludes such diseases as chlorosis, primary pernicious anemia, splenic anemia, and the leukemias, which to all intents and purposes are genuine idiopathic conditions arising without a discoverable adequate cause. It includes anemias due to loss of blood; to inanition from poor assimilation and loss of body albumins; to the absorption of metallic poisons; to the action of toxins generated in various acute and chronic infections; and to the hemolytic effect of hyperpyrexia.

The three essential factors of secondary anemias, above noted, more often work in combination than singly, as, for example, in the anemia sometimes accompanying chronic digestive disorders, which originally begins as the result of insufficient assimilation of food, but which is certainly aggravated—who can say to what extent?—by the noxious action of toxic materials absorbed from the gastro-intestinal tract. Similarly, in intestinal helminthiasis a catarrhal gut must contribute not a little to the anemia primarily due to the hemolytic action of helminthic toxins, and in some cases much blood is sucked from the mucosal surfaces. In gastric cancer two, perhaps three, factors must be reckoned with in identifying the sources of the blood impoverishment—the altered condition of the gastric mucosa and wall, the effect of absorbed cancer toxins, and, in some cases, hemorrhage. In chronic Bright's disease the subject becomes anemic not only from insufficient assimilation, but also from excessive draining away of the system's albumin, and, perchance, from the destructive inroads of circulating autogenous poisons.

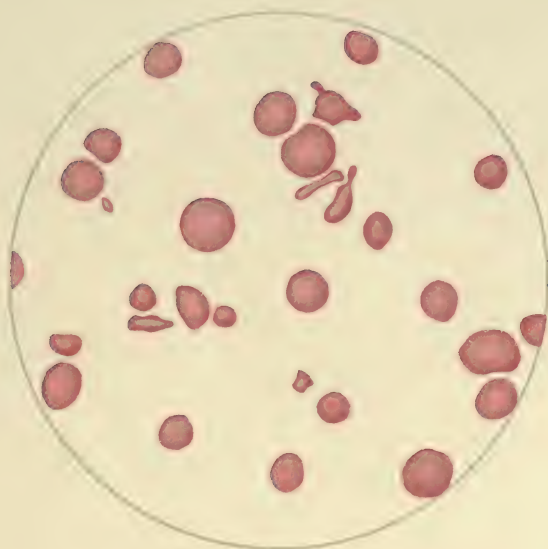
On the other hand, anemia referable to a single definite cause arises from a hemorrhage of sufficient gravity to lower the quantity and the

quality of the blood; and one also is able to trace the blood defect to some one fault in the anemias secondary to syphilis, malarial fever, lead poisoning, and malignant disease, in all of which a specific toxemia is generally regarded as the ruling influence.

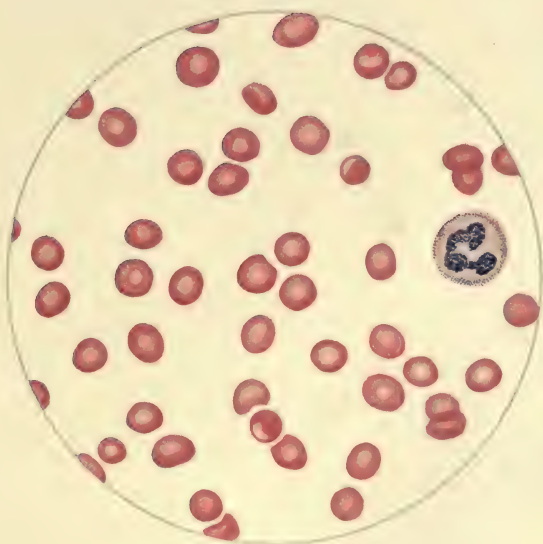
From the foregoing summary it naturally follows that the intelligent management of a case of secondary anemia must have for its objects, first, the removal of the exciting cause or causes; and second, the repair of the blood loss by hematinics and by hygienic and dietetic methods.

Of the first indication, it will be sufficient here to offer merely a general statement to the effect that cure of a secondary anemia is quite out of the question until its underlying cause has been identified and eradicated—quinine must have the first call for ague, iodides for lues, thymol for hook-worm, and the knife in cancer. The second object of treatment relates to the use of blood-builders, pharmaceutical, dietary, and physical, and calls for more specific consideration.

In secondary anemias as a class the blood changes of most interest to the therapist exhibit the widest possible latitude in individual cases, according to the character of the exciting cause of the blood defect and the persistence of its inroads on the patient's constitution. In a simple nutritional anemia the hematological examination may show nothing more serious than a trifling deficiency in the hemoglobin percentage, with a commensurate loss of erythrocytes, and either a normal leukocyte count or a moderate leukocytosis of the polymorphonuclear neutrophile type. In such an instance the therapeutic question is readily settled by the adoption of a proper dietary, the correction of faulty hygienic conditions, and the prescription of some one of the assimilable iron preparations. When, however, toxic factors are the dominant offenders, the blood shows evidences of much greater deterioration, for here not only are the hemoglobin and erythrocyte values more decidedly subnormal, but these changes are accompanied by indications of structural degeneration of the erythrocytes and by deviations from the normal leukocyte formula. In the anemia secondary to lead poisoning, for example, it is common to find some 40 or 50 per cent. loss of hemoglobin and erythrocytes, many of which cells are distorted in shape and size and show more or less extensive signs of stroma death, while the leukocytes consist largely of lymphocytic forms, increased in number at the expense of the polynuclear neutrophile varieties, derived originally from the bone marrow. In scorbutic anemias there may be striking structural degeneration associated with a cellular deficiency fully equal to that ordinarily met with in genuine pernicious anemia. In anemias of these types, removal of the exciting cause is obviously the first therapeutic indication, to which the administration of blood-builders, though essential, must be chiefly supplemental. The same remarks are equally applicable to that class of secondary anemias provoked by certain intestinal worms, especially the *Ankylostomum duodenale* and the *Bothriocephalus latus*, in each of which conditions the blood destruction at times attains a most extreme degree. Indeed, the latter variety of helminthiasis may account for a blood-picture identical with that of true



Before treatment.



After nine weeks' treatment with iron and arsenic.

pernicious anemia, the differentiation, aside from the history of the patient, being based solely upon the fact that in the tapeworm anemia the normal blood picture returns and health is regained after expulsion of the parasite by the administration of an appropriate vermifuge. As an illustration of the comparative differences in the blood changes ordinarily found in the several clinical types of anemia, the following hemoglobin and erythrocyte averages,¹ which I have calculated in 200 consecutive blood examinations, may be of interest:

Type of anemia.	Hemoglobin loss, per cent.	Erythrocyte loss, per cent.
Secondary anemia	44.8	27.1
Chlorosis	54.8	17.8
Pernicious anemia	60.6	45.4
Leukemia	74.5	76.9

Apart from food, which is the ideal hematinic, iron, arsenic, and various pharmaceutical "tonics" are of utility in building up the blood deterioration in individuals suffering from a secondary anemia of definite origin. Of the merits and demerits of the various iron salts, it would be futile here to attempt to frame an acceptable statement, in the face of the conflicting views prevailing on this moot question. Whether one holds to Bunge's belief² in the direct systemic utilization of the organic iron preparations and the non-absorbability of the inorganic, or whether one admits of the assimilation of neither, the clinical fact remains that both the organic and the inorganic irons are capable of improving the quality of impoverished blood when given under certain conditions not entirely understood at the present time. This much, however, is admitted: That, given a healthy digestive tract, it is reasonable to presume that both natural food iron and synthetic organic iron salts are absorbed directly and converted into hemoglobin, but with a disordered digestion no such effect can be expected to follow the ingestion of any form of iron. Furthermore, inorganic iron preparations, though their absorbability may be open to question, certainly promote the assimilation of food iron when the two are administered in combination, probably because they combine with the intestinal hydrogen sulphide and thus prevent precipitation of the food iron. In contrast to this function of the inorganic salts, attention should be paid to Hatcher and Wilbert's statement,³ that "organic iron preparations are without beneficial effects under similar circumstances."

The particular form of iron selected for administration in a case of secondary anemia is largely a matter of personal choice on the physician's part. Provided that the patient's appetite is unimpaired and digestion natural, some one of the inorganic salts can generally be prescribed with confidence. Pills of the dried sulphate of iron (*Ferri sulphas exsiccatus*), in daily doses of 6 or 8 grains, amply meet the requirements

¹ Clinical Hematology, Philadelphia, 1905, 2d ed., p. 297.

² Verhandl. XIII Congress f. inn. Med., 1895, i, 133.

³ The Pharmacopeia and the Physician, Chicago, 1906, p. 74.

of the average case; or one may order one of the iron scale preparations, such as the citrate of iron and ammonia (*Ferri et ammonia citras*), 4 grains of which may be taken three or four times a day, either in capsules or in combination with one of the aromatic elixirs. Sherley reports¹ most rapid improvement in "pretuberculous anemias" from the use of this iron salt (gr. 0.1) in combination with sodium arsenate (gr. $\frac{1}{500}$), which he gives hypodermically deep into a muscle. The ammoniated citrate is also warmly advocated by Morse² in the treatment of certain secondary anemias met with in infancy and childhood. In my experience, restricted mainly to anemias in adults, iron citrate by needle has not demonstrated its superiority to organic iron by mouth, nor is this salt more active than such inorganic substances as Blaud's carbonate and the dried sulphate of iron. Quevenne's reduced iron (*Ferrum reductum*), in doses of 6 or 8 grains *per diem*, is an efficacious, a tasteless, and a very moderately astringent chalybeate, which enjoys a deservedly wide popularity. To serve as a combined hematinic and stomachic some one of the iron wines, two fluidrams of which should be given before each meal, is a most useful remedy, and for this double purpose either the bitter wine (*Vinum ferri amarum*) or the citrated wine (*Vinum ferri citratis*) may be chosen as a pleasant preparation of the metal. Ordinarily the tincture of the chloride of iron (*Tinctura ferri chloridi*), being most astringent, is not preferred as a hematinic for prolonged administration, but despite this apparent drawback to its use in large doses, in small amounts combined with a sour vehicle this preparation frequently acts as an appetizer, quiets a squeamish stomach, and improves the blood. Five drops of the tincture added to a tumblerful of sour lemonade, three times a day, is not an unpleasant draught, and will usually produce beneficial results with promptness. When the other salts of iron cannot be taken by the patient, either for real or for fancied reasons, S. Weir Mitchell³ is accustomed to prescribe a ferrated malt, made by adding 5 grains of iron pyrophosphate (*Ferri pyrophosphas solubilis*) to each fluidounce of a good malt extract, and with a formula of this sort it is stated that gastric disturbances, costiveness, and headache need not be feared.

The numerous other iron preparations, unmentioned in the foregoing paragraph, call for but brief notice—merely a suggestion of their particular fields of usefulness in special types of anemia. For example, the valerianate of iron (*Ferri valerianas*) is regarded as a useful remedy in nervous, pallid women; the iodide of iron, in the form of the syrup (*Syrupus ferri iodidi*) fulfils definite indications in scrofulous anemias better than any of the other chalybeates; the tincture of the chloride of iron (*Tinctura ferri chloridi*) and Basham's mixture (*Liquor ferri et ammonii acetatis*) are serviceable both as hematinics and as diuretics in the chronic parenchymatous nephritides. Such hints as these are all that are necessary to guide one in selecting an appropriate iron salt

¹ Jour. Amer. Med. Assoc., 1906, xlv, 6.

² Ibid., 1909, lii, 455.

³ Fat and Blood, Philadelphia, 1900, 8th ed., p. 142.

when considering the therapeusis of a secondary anemia from an etiological standpoint.

Organic iron preparations, legion in number, have not displaced the inorganic salts in the hands of the practical clinician, contrary to the sanguine claims of those who manufacture these proprietaries. On the whole, the organic irons, of which the albuminate is a good representative, appear to act most favorably in patients whose food intake, for one reason or another, is inadequate.

Arsenic in combination with iron is indicated in numerous instances, particularly in those characterized by disproportionately subnormal erythrocyte values, and under these circumstances the drug appears to exhibit a true stimulating influence upon marrow hematopoiesis. The particular arsenical preparation chosen is of secondary importance. As elsewhere noted, either Fowler's solution of potassium arsenite (in initial dose of 3 minims, with a daily increase of 1 minim until 10 minim doses are reached) or a pill of sodium arsenate (gr. 0.1 to 0.05) will generally be the first choice of the clinician; or one of the newer arylarsenates may be given a trial (see p. 269). The future must decide whether Ehrlich's "606" (the sodium salt of dioxylidiamidoarsenobenzol) possesses hematinic as well as antisiphilitic properties of real value. Manganese, phosphorus, and various other substances reputed to possess blood-making qualities in no sense can take the place of iron and arsenic. Cod-liver oil and olive oil, as a supplement to the metallic hematinics, are useful, so long as their administration does not disorder the patient's digestion.

It is easier to suggest than to enforce an adequate dietary for an anemic subject, in view of which it follows that to tempt the palate is quite as important an essential as the selection of proper food. Culinary skill, the use of appetizing condiments, and the service of food in small quantities at frequent intervals are helpful aids in overcoming this dietetic apathy, and in some instances alcohol, in the form of whisky and soda, claret, and other light, sour wines, will whet the appetite for solid food. Other familiar remedies employed for the same purpose include the so-called stomachics, of which, gentian, quassia, cinchona, and cicicifuga, commonly combined with *nux vomica*, seem to enjoy perennial popularity.

Inasmuch as the average normal daily ration contains not more than $\frac{1}{8}$ gr. of iron—and this chiefly in combination with the meat juices—it is clear that general nutritive properties, rather than an excessive chalybeate content, is the principal object to be kept in mind in planning the dietary of an anemic person. This dietary should consist largely of meats, milk, eggs, and fats, with a predominant portion of carbohydrates, should the patient be lean and poorly nourished. The diet should be mixed—too much meat means dyspepsia and costiveness, with their inevitable recourse to artificial digestants and to laxatives; an undue quantity of starchy vegetables overtaxes the intestines, and makes for indifferent staying qualities.

Rare beefsteak or rib-roast, lamb, young mutton, chicken, and

squabs offer a variety of animal foods sufficient for the needs of the average patient, who should rigidly abstain from veal, ham, and other kinds of pork, with the exception of bacon. The total daily ration of these animal foods preferably ranges between 4 and 8 ounces. Fish, never fried or cured, is usually eaten with relish, and of oysters and tender clams the same is true. It is scarcely necessary to state that lobsters, crabs, and shrimps must be excluded from the menu. Raw, soft-boiled, and poached eggs are valued and generally acceptable foods (save in an occasional patient who cannot seem to digest them), or they may be served as omelettes and custards and with sherry and milk. Milk alone, when well tolerated, may be given in quantities of at least one quart each day, as a supplement to the rest of the dietary. Thoroughly cooked cereals are useful additions to meat, milk, and eggs, and of such foods, oatmeal, wheat gruel, hominy, rice, brown bread, corn bread, and Graham bread are the favorites. The seasonable vegetables, especially the "greens," are excellent food, and this also applies to the fresh fruits in general. Simple desserts, like stewed fruits, jellies, ice-cream, rice and tapioca pudding, and junket, are not to be denied. Tea and coffee should be used sparingly; cocoa and chocolate freely, and such articles as fried and richly gravied foods, potted meats, hot breads, cakes, candy, confectionery, preserves, pickles, and nuts do more harm than good.

As an adjunct to the therapeusis already described, *hydrotherapy* has a distinct field of usefulness in the cure of anemia, particularly in those types associated with considerable autotoxemia, defective elimination, and sluggish action of the blood and lymph circulations, in which conditions a course of tonic water baths, combined with exposures in the electric light cabinet and with gentle massage, rarely fails to hasten convalescence and to produce in the patient a sense of exhilaration and general well-being within a surprisingly short time. In such instances it is my practice to order a course of twelve or more treatments, at tri-weekly intervals, each séance consisting of an electric light bath of from five to ten or twelve minutes' duration, followed by a tepid (80° F.) full needle spray lasting two or three minutes, after which the patient is gently massaged for twenty minutes, and finally given a brisk alcohol rub. While in the electric cabinet bath the patient's head is encased in an ice-cap and the neck encircled with a cold, wet towel, diaphoresis meanwhile being encouraged by sipping a glass of iced water. A satisfactory sweat, as a rule, takes place promptly and without the subsequent feeling of depression or exhaustion so commonly observed as the result of hot vapor baths. The massage after the bath and douche must never be violent enough to produce anything more than a sense of grateful fatigue on the part of the patient, and the observance of this essential factor of success must be impressed upon the operator, for the average masseur—and to a less extent the average masseuse—is prone to consider skill synonymous with rough handling. The most useful manipulations for the debilitated anemic subject consist of slow effleurage performed with moderate and centripetally directed pressure, circular friction, and the kneading motions known as *pétrissage*.

Tapotment, knuckle-kneading, and other vigorous manipulation are to be studiously avoided, except over the abdomen, in those with constipation as an obstinate symptom. Rest and complete physical relaxation for at least thirty minutes terminate each treatment, during the intervals between which the patient should spend much time in the open air and sunshine, and take outdoor exercise up to the point of fatigue.

CHLOROSIS.

The action of iron in chlorosis is a familiar illustration of therapeutics to which the somewhat loosely applied adjectives specific and curative are appropriate in their fullest sense. No chlorotic fails to recover under the intelligent use of iron, and it is almost permissible also to state that none can recover without it. Iron, then, is the sheet-anchor, so to speak, of the treatment, and from the effect of this metal one can confidently anticipate the prompt restoration of the normal blood-picture, the return of color to blanched mucosæ and pallid skin, and the relief of a complex symptom group no less distressing to the patient than perplexing, in its protean and bewildering phases, to the medical attendant.

In the typical example of chlorosis the prime object of treatment is the correction of an unnaturally low color index, by which phrase is meant a disproportionately low percentage of hemoglobin in the individual red corpuscle, and the progress of this change can (and should) be followed, week by week, with the aid of the hemoglobinometer. The diminution of erythrocytes which accompanies this hemoglobin deficiency is usually moderate, though in an occasional instance one must also combat a well-defined, though rarely extreme, cellular loss. A prompt response on the part of the erythrocytes is the first sign of consequence to be observed, as the ferruginous effects are exerted, and as the result of this stimulus the erythrocyte count steadily and quickly mounts upward, not uncommonly at the rate of a million or more cells per cubic millimeter each fortnight. The leukocytes, which ordinarily are normal or even subnormal in number, may also increase to a slight extent at the beginning of treatment, but this change is of no clinical importance, nor is it usually conspicuous and permanent enough to attract the examiner's attention. The hemoglobin increases much more slowly than the erythrocytes, and the lagging behind of this constituent accounts for the stubbornly persistent subnormal color index in the face of a normal erythrocyte figure, which is so characteristic of the incompletely cured case of chlorosis. Let it be emphasized here that no chlorotic should be pronounced cured until her color index has been reëstablished beyond all reasonable doubt, and until her red cells have attained or overstepped the average standard of health. A "relapse" of chlorosis more often indicates careless therapy than a true recurrence of the disorder.

Blaud's pill (*Pilulæ ferri carbonatis*) is by all odds the most generally satisfactory form of iron for the treatment of chlorosis, inasmuch

as its astringent properties are not excessive, nor does its continued administration tend to produce unpleasant by-effects, such as headache, indigestion, and constipation. Should, however, the bowels become sluggish after its prolonged use, Blaud's pill may be combined with small doses of cascara sagrada or with phenolphthalein, in order to counteract this tendency. Or the patient may keep the bowels free by drinking some soured milk preparation, as advised by Luke.¹ Ordinary baker's yeast also counteracts any tendency to constipation, for which purpose half an yeast cake, dissolved in a tumblerful of water, should be taken twice daily.

Although, as a class, chlorotic subjects can take without discomfort large amounts of iron for a protracted period, there is by this token no justification for the excessive ferruginization once in vogue, and, unfortunately, still practised in quarters where therapeutic tradition rules. The average patient will do well on three Blaud's pills each day for the first week, six pills a day for the second week, and nine pills a day for the third week and thereafter until the blood-picture becomes normal, after which time the drug should be gradually withdrawn at a rate inverse to that guiding its progressive increase during the first three weeks of treatment. According to the plan just outlined, the patient received daily 7.5 grains of iron during the initial week of her treatment, 15 grains daily during the second week, and 22.5 grains daily during the third week and thereafter until cured—an amount of the metal which is usually tolerated without causing discomfort to the patient, and which, it is needless to add, is more than amply sufficient, as a hematopoietic stimulant, as an actual store of iron for absorption, and as a chemical preserver of the food iron existing in the gut.

In prescribing Blaud's pills it is most essential to see that they are freshly made, so as to insure the patient's getting a true ferrous carbonate, and not merely an irritant oxide, of which, unfortunately, some of the brands of stale "stock" pills are largely composed. An exceptionally active "stock" Blaud's pill, popular in Great Britain, is so compounded that no interaction of its ingredients can take place until it reaches the stomach, when by the action of the gastric juice nascent ferrous carbonate is produced in a pure and readily absorbable form.

If, for any reason, Blaud's pills should not be adapted to the individual case, the sulphate of iron may be tried, preferably as advised by Albutt,² in one-grain pills thrice daily for the first week of treatment, twice this dose in the second week, and thrice the initial dose in the third week and thereafter. With this form of iron one must be prepared to meet with gastric disturbances more frequently than when the carbonate of iron is prescribed.

Murrell³ is also an advocate of the dried sulphate of iron, from the effect of which, in tridaily doses of 5 grains, he found that the average

¹ Practitioner, 1910, lxxiv, 653.

² System of Medicine, London, 1909, 2d ed., v, 720.

³ Med. Press and Circular, 1904, lxxxviii, 4.

chlorotic gained 1 per cent. of hemoglobin and 2 per cent. of erythrocytes *per diem*. With iron vitellin, this author's favorite organic chalybeate, he obtained even more convincing results than afforded by the most active of the inorganic iron preparations.

The tincture of the chloride of iron also has its adherents, and in certain cases, notably those with stubborn loss of appetite, the use of this alcoholic liquid iron, best administered in a syrupy vehicle, is attended with prompt and gratifying improvement. With the foregoing iron preparations available—not to mention the many others listed in the Pharmacopœia—there is no excuse for resorting to the high-priced proprietary (organic) irons whose unique virtues are so widely promoted in the advertising pages of medical periodicals. With none of them is the hemoglobin gain more rapid or more stable than it is when some one of the standard iron salts, above referred to, is given.

Despite the contentions of the laboratory physiologist that hemoglobin cannot be manufactured by the human organism from ingested inorganic iron, the clinical experience that inorganic iron, such as Bland's pill, does increase the hemoglobin percentage of the blood is a matter of fact beyond all serious dispute. This clinical finding, too, is rendered less arbitrary by subscribing to the views of Meyer,¹ who maintains that no ingested iron, whether it be organic or inorganic, is directly transformed into hemoglobin, but must first pass through a preliminary conversion into ferratin in the liver, which organ, as is well known, is a storehouse whence hemoglobin-forming material is drawn upon by the economy of the body, according to its varying needs. Meltzer's studies² also bear out this theory, and, incidentally, corroborate the utility of inorganic irons, so convincingly proved by purely clinical results.

In addition to iron, arsenic is distinctly indicated in the great majority of chlorotic patients, inasmuch as more or less diminution in the number of red corpuscles is commonly associated with the more characteristic loss of hemoglobin, and in the exceptional instance an actual high-grade cellular anemia may virtually dominate the blood-picture. Of 155 cases of chlorosis of which I have personal records, almost one-fifth were attended with an erythrocyte count below 3,000,000 per c.mm., while for the same series the average cellular loss amounted to 24 per cent., and the hemoglobin deficiency averaged more than double this figure, or 53 per cent. Fowler's solution (*Liquor potassii arsenitis*), than which no more satisfactory arsenic preparation exists, answers admirably in the chlorotic anemias, in which the drug is a valuable adjunct to the iron medication. In doses of from three to five drops, thrice daily, it excites neither renal nor gastric irritation, save in very susceptible individuals, while exerting stimulation of the bone marrow and at the same time whipping up the secretion of the thyroid gland. Arsenous acid (*Arseni trioxidi*), in tridaily doses of $\frac{1}{30}$ gr. must be considered as an indifferent substitute for the preparation just mentioned, nor can the

¹ *Ergebn. d. Physiol.*, 1906, v, 2.

² *Jour. Amer. Med. Assoc.*, 1907, xlix, 639.

somewhat popular *Sodii arsenas*, given in the same doses, in any sense replace Fowler's solution in the routine management of the anemia of chlorotic women.

Of atoxyl, the cacodylates, and their congeners, there is little to be said in favor of their use in treating a chlorotic anemia. The true field of usefulness of this class of drugs is in the more acute types of so-called primary blood diseases, such as pernicious anemia and leukemia, in connection with which disorders the utility of these arsenic preparations will be discussed in detail (see p. 269).

Apart from the routine administration of iron and arsenic, other therapeutic measures must receive consideration, so as to deal adequately with the chlorotic symptom-complex as a whole and with the separate minutiae thereof. In attacking the first problem—namely, the betterment of the patient's general condition—one must constantly bear in mind the prime importance of rest, food, and pure air as essentials to a case management designed on broad, intelligent lines. Despite the fact that iron is a specific for chlorosis, its use should be supplemented by careful attention to the physical details just mentioned, in order that the clinical course of the disorder may be shortened and its cure made doubly certain. In carrying out these particulars it is obvious that, at least in private professional work, the willing coöperation of the patient must be enlisted, as an indispensable requisite for the best results, and efforts must be made (and renewed) to insure the patient's adherence to a few simple details of treatment, the neglect of which may largely offset the benefits of drug giving and unnecessarily prolong convalescence. The second problem—that relating to the special symptoms of the chlorotic state—includes a medley of complaints, both real and fancied, the correction of which oftentimes taxes to the utmost even the seasoned physician's store of skill and patience, and with such items as these subsequent paragraphs will treat in detail (*vide infra*).

Rest in bed must be insisted upon as a necessary part of the management of every case of chlorosis which has reached even a tolerably acute stage. It is particularly desirable in subjects in whom cardiovascular symptoms play a prominent part, and under such circumstances a complete physical relaxation, aside from its other good effects, greatly modifies, if not entirely removes, such distressing complaints as dyspnea, palpitation, and vertigo, while it quickly restores the boggy, swollen ankles to their natural size. Even in the absence of obvious circulatory distress, absolute rest in bed is a means of hastening convalescence, and it should therefore be advised as a routine measure, at least for the first fortnight or two of the treatment period. Indeed, after the patient has grown decidedly better she should be induced to spend the mornings in bed and to "nap" for a short period toward the end of the afternoon. A chlorotic's languor and asthenia are real, despite her apparently well-nourished frame, and such indisposition is only aggravated by physical exertion, mistakenly advised under the impression that the patient needs exercise. This should, of course, be taken later on, after a stable betterment of the blood deficiency has been attained.

Pure air and an abundance of sunshine also count for much in the management of chlorosis, and, should circumstances permit, the patient may advantageously spend much of her treatment period out of doors, or, at any rate, beside an open window. Whenever possible, a country or a sea-side environment is to be selected, instead of the city, and if the invalid be forced to remain in town, her room should be swept by freely circulating air and exposed to a maximum of sunshine. Plenty of sleep, preferably not induced by hypnotics, is a desideratum.

Systematic hydrotherapy in conjunction with the electric light bath, practised according to the plan already described (p. 256), has proved, in my experience, of the greatest utility in the management of chlorosis, possibly because these procedures combine the well-known benefit of heat and balneotherapy with that arising from increased absorption of iron from the liver induced by the concentrated actinic influences. Rosin¹ treats chlorotics by a twenty-minute hot (104° F.) tub bath, followed by a cold douche, a brisk rub, and a rest of one hour, and by this routine he believes that actual stimulation of the bone marrow is set up. Hot mud baths are highly beneficial in chlorosis, says Steinberg,² who maintains that a specific action upon the ovaries, presumably at fault in this affection, is thereby produced.

The selection and enforcement of a satisfactory dietary is, perhaps, the most difficult single detail encountered in treating chlorotics, who, as a class, show a most pronounced aversion to the very foods that their thin blood requires—fats, rare meats, eggs, and milk. Furthermore, the digestive derangements, which so commonly are the most conspicuous detail of the clinical picture, are a further barrier which interferes with giving as full a dietary as the condition calls for, and these defects are to be overcome by such measures as lavage and by the use of the various digestive ferments, before assimilation can take place in an adequate manner.

From three to four ounces of butter generally can be incorporated with the daily ration, without annoyance to the patient; or, if preferred, clotted Devonshire cream, made palatable by adding a dash of sherry and a little sugar and grated nutmeg, may be chosen as a satisfactory substitute. Rich raw milk (or peptonized milk, if the patient's stomach rebels) may be taken, in tumblerful portions every third hour, during the morning and afternoon, and to this mainstay of the dietary should be added eggs, which may be given raw, soft boiled, poached, or in the form of a very mild nog. Lactic acid milk, prepared with true Bulgarian cultures, is an agreeable draught to most persons, and, aside from possessing good nutritive properties, has the additional merit of scavenging the intestinal canal and of minimizing fermentative processes therein. In advising eggs and milk one must be careful not to overfeed, inasmuch as some individuals do not take kindly to either of these articles of diet, and the exact quantities to be taken per day are to be deter-

¹ Ueber Bleisucht und ihre Behandl., Berlin, 1905, 193.

² Berl. klin. Woch., 1907, xlv, 450.

mined individually, according to the personal adaptability of the patient. Sometimes one is compelled to proscribe, rather than prescribe, them. Fat, in the form of crisp fried bacon, is a valuable addition to the foregoing dietary, and is relished and well digested by the average patient, but rarely is it necessary to resort to such distasteful fats as either olive oil or cod-liver oil.

Though, as a rule, the patient will not relish it, one should insist upon the free use of meat, prepared as temptingly as possible, with plenty of salt and well seasoned with pepper, so as to excite the activity of a torpid stomach. Beef is to be preferred to all other meats, and the nearer raw it can be eaten the better the result. W. Gilman Thompson¹ speaks well of pounded beefsteak sandwiched, with lettuce leaves, between slices of buttered bread, as a palatable and wholesome way of preparing the meat ration; or it may be given as a minced meat cake, crisply browned on the outside but practically blood red beneath this crust. About six ounces of meat each twenty-four hours is the most that the average patient can be induced to eat, although in some instances Sée² is accustomed to order as much as fourteen ounces a day. It is scarcely necessary to state that veal and pork (save bacon) are unsuitable meats for the chlorotic. If it seems best not to insist upon the patient's eating solid meats, raw scraped beef, plain beef juice, and concentrated beef broths may be given a trial, or similar broths and consommés of mutton and of chicken. An abundance of fresh fruits, together with lettuce, watercress, spinach, asparagus, and other seasonable greens, help to round out the bill of fare, of which the starchy vegetables, such as potatoes, beans, peas, and corn, should constitute but a modicum. Alcohol is no wise indicated as a part of the routine treatment, although some practitioners order a glass of stout or claret or Burgundy to be sipped with luncheon or dinner. Ringer's effervescing lemonade is most efficient in controlling that peculiar craving for acids so commonly met with in the chlorotic girl. It is prepared by adding to half a pint of iced water the juice of one large lemon, sweetening with a lump or two of sugar previously rubbed against the rind, and made effervescent by the addition of about half a teaspoonful of sodium bicarbonate. On the other hand, Vichy or another alkaline water of this class serves better to control the pica in some patients, while in others it may be thought advisable to prescribe one of the chalybeate waters. Carlsbad Sprüdel, Hunyadi, Epsom, and Rubiñat waters (invariably to be sipped slowly, while piping hot) are useful morning potions to rid the stomach of irritant mucus and to unlock the bowels.

In considering the minutiae of the chlorotic symptom group the medical attendant's first impulse may be to acquiesce with the patient's demands for immediate relief by drugs, thereby beginning a regimen of elaborate and quite needless drug-giving. As already suggested, many of these symptoms are purely imaginary, and most of them are but part and

¹ Practical Dietetics, New York, 1909, 4th éd., p. 540.

² Cited by Thompson, loc. cit.

parcel of the disease itself, and it follows that counsel and cheer and encouragement by the doctor go far to allay the first-named set of ills, and that the latter will surely disappear as the good effects of the iron and food and rest are felt. But despite these facts, one must be alert to distinguish the true from the false, and to relieve certain special symptoms, both inherent and complicating, which may arise from time to time during the illness, and these symptoms, relating mainly to the gastro-intestinal tract, to the nervous system, and to the heart, it seems best now to consider at some length.

The *gastro-intestinal disturbances* so commonly associated with this disease are a source of great distress to many patients, and may demand, more than does any other group of the symptom complex, the sane use of drugs, in addition to other remedial agencies. Constipation, flatulent dyspepsia, and a heavy breath with a coated tongue form a familiar combination of ills in many patients; others have true dilatation of the stomach; some suffer from peptic ulcer; and nearly all have an impaired appetite, if not complete anorexia.

Whenever possible to do so, it is best to counteract constipation by urging the subject to eat freely of green vegetables, salads, fats, and fruits, both fresh and stewed. When dietetic methods fail to relieve the trouble, enemata are in order, and if drug laxatives must be resorted to, one of the saline waters noted above may answer the purpose; or a small dose of cascara sagrada, aloes, and phenolphthalein may be taken each night on retiring. Nothing is better, in the long run, than the well-known phenolphthalated "A. S. and B." pill, consisting of aloin, gr. $\frac{1}{8}$; strychnine nitrate, gr. $\frac{1}{80}$; extract belladonna, gr. $\frac{1}{8}$; extract cascara sagrada, gr. $\frac{1}{4}$; and phenolphthalein, gr. $\frac{1}{4}$. Whatever be the means employed, the stools should be kept of a mushy consistence, and the formation of scybillaë forestalled. When there is reason to suspect sluggishness and inspissation of the bile, it is well to put the patient on a course of salicylates and acid sodium oleate, in order to insure a free output of this natural intestinal antiferment. To this end there may be administered, after taking food, tridaily doses of a capsule containing acid sodium oleate, gr. v; sodium salicylate, gr. v; and menthol, gr. $\frac{1}{10}$, to which may be added, should the occasion so indicate, a small amount either of cascara or of phenolphthalein. As soon as the stools become free and dark and soft (usually within four or five days), this treatment is to be discontinued, to be resumed when the original indications again arise.

For the flatulent dyspepsia and attendant symptoms the several internal antifermentatives and antiseptics have an important place. If it be merely a question of hyperacidity, some simple combination like sodium bicarbonate and bismuth, of each 20 grains, flavored with essence of peppermint, will usually control the troublesome pyrosis and gastric distress. If the latter be really acute and attended with much distention, speedy relief, with the eructation of great quantities of gas, may be obtained by giving, at half-hourly intervals, thirty-drop doses, in iced water, of a mixture of equal parts of spirits of camphor, spirits of chloroform, and

Hoffman's anodyne. Such a homely remedy as charcoal, in 30 gr. powders, should not be omitted from the list of antifermentatives. For a subnormal acid content of the gastric secretion one turns to hydrochloric acid and pepsin, which, if mixed with glycerin and orange flower water as a vehicle, are not disagreeable to take; each teaspoonful of such a mixture should hold 2 grains of the ferment and 5 minims of the acid, the dose being 2 drams, well diluted, directly before taking food. Pancreatin, diastase, and betanaphthol comprise the array of drugs ordinarily indicated for the correction of intestinal indigestion and fermentation.

For the relief of the gastric distress due to accumulation of mucus in the stomach, Eustace Smith¹ advises daily morning lavage and the administration of 20 grains of zinc sulphate, to be taken on an empty stomach, immediately after the organ has been washed out.

In the presence of an associated gastrectasis it is necessary to devote quite as much attention to this complication as to the primary defect of the blood, though this expression is not to be construed as subscribing to Pick's contention that chlorosis depends upon a hemolysis arising from poisons generated within, and absorbed from, a dilated stomach. In the presence, then, of this condition the plan of treatment naturally is directed especially toward the prevention of gastric fermentation, the complete emptying of the stomach within the normal period of gastric digestion, and the selection of an appropriate dietary. Gastric fermentation, if but moderate, possibly can be kept within bounds by the administration of some of the antifermentatives above referred to, but usually the stomach tube will prove much more effectual than pharmaceutical measures. Theoretically, it would seem best to empty the stomach after each meal, but it is more practicable to adopt Friedenwald's method of washing it out once a day, just before the evening meal, or, in cases in which food remains in the stomach overnight, to resort to an additional séance early each morning. As to diet, it is sufficient to note here that frequent small-sized meals of easily absorbable "dry" foods, which neither overload the stomach nor linger long therein, are the most suitable. The reader should consult text-books on dietetics for further information about this important subject.

In cases with co-existing gastric ulcer the foregoing advice also is germane, whether the lesion be reputed as a cause or as an effect of the blood dyscrasia, and under such circumstances bismuth, silver nitrate, and opiates are the drugs most confidently relied upon at the present time. Still better, the patient, in addition to her routine treatment for chlorosis, may be placed upon the admirable régime devised by Leube, based upon the systematic use of Carlsbad salts, boracic ointment poultices, and a special nitrogenous diet.

The numerous *nervous symptoms* incident to the chlorotic state do not, as a rule, call for treatment other than that planned as a cure for the underlying blood defect. Especially is this true of those neurasthenic

¹ Brit. Med. Jour., 1908, ii, 1144

patients whose chief complaint is petulance and ill-temper and fretfulness; of those in whom apathy and depression and even melancholy are the ruling feature; and of the group dominated by hysterical manifestations. Under these circumstances it is apparent that a personal word of suggestion and encouragement will do far more for the patient than an elaborate course of nervines and like drugs. When sedatives seem indispensable, strontium bromide and the isovalerianates suggest themselves as both efficacious and non-depressant. In some chlorotics severe neuralgias, as of the face, the thorax, and the stomach, cause such suffering as to require relief by medicine. If in a given instance of this sort the pains do not yield to some local application (dry heat, inunctions of menthol-methyl salicylate ointment) it is better to use, guardedly, one of the less depressant coal-tar analgesics than to allow the patient to suffer unnecessarily, and for this purpose acetphenetidin (2.5 gr.) combined with camphor monobromate (0.5 gr.) and salol (0.5 gr.) generally affords speedy relief, after a few doses have been administered at intervals of an hour or two. The nervous cough, sometimes a most annoying symptom in chlorotics, needs no special attention, but the examiner should satisfy himself of its purely functional character, in order to rule out a co-existent phthisical lesion. In this connection it is of interest to recall Labbé's belief¹ that in the so-called chlorosis of puberty the blood dyscrasia may be interpreted as an early pretuberculous sign.

The disorders referable to the *cardiovascular system* are best controlled by rest, the ice-bag, and the persistent use of iron, which therapeutic trilogy will in time surely calm the overwrought cardiac nerve mechanism and restore the unnaturally thin blood to its normal density. There is no excuse for ordering drugs which selectively affect the heart and vessels in attempting to relieve the dyspnea and palpitation and disorderly pulse of the chlorotic patient.

PRIMARY PERNICIOUS ANEMIA.

In primary pernicious anemia the chief feature of the blood-picture consists of an extreme diminution in the number of erythrocytes and a relatively more moderate, though no less striking, loss of hemoglobin, together with the presence of certain nucleated red corpuscles and of other cells disfigured by signs of structural degeneracy affecting their size, shape, and cell stroma. It is apparent that this relation of hemoglobin to cell, which accounts for the high color index so typical of pernicious anemia, is diametrically opposite to that prevailing in chlorosis, for in pernicious anemia the individual red corpuscle contains an excess content of hemoglobin (high color index), while in chlorosis each cell's portion of hemoglobin is deficient (low color index).

Of the nucleated red cells, or erythroblasts, those conforming to the

¹ Bull. et mém. Soc. méd. d. Hôp. de Paris, 1904, xxi, 989.

megaloblastic type are of particular interest from a diagnostic viewpoint, in that such cells, in typical cases, actually outnumber all other kinds of nucleated red corpuscles, and are to be interpreted as an indication of embryonal reversion of the bone marrow, which tissue in pernicious anemia becomes so crippled that it throws off into the blood stream numbers of fetal (nucleated) red blood corpuscles, along with various others more nearly approaching the normal standard, both in form and in functioning properties. These predominating megaloblasts are the essential cellular defect peculiar to this variety of anemia, and they clearly betoken a condition of the marrow existing during the period of embryonal development, but totally foreign to postuterine life. This, then, is the change which prevails, to a more or less extensive degree, in all instances of true Addisonian anemia to which the significant adjective "pernicious" is applied, for lack of a more comprehensive word. The mere presence of normoblasts in pernicious anemia is no wise distinctive of this disease, inasmuch as such cells may enter the general circulation in any type of intense anemia, be it of sufficient severity, and point to a state of stimulated and imperfect hemogenesis, as the result of which partly developed, immature forms of the red corpuscle prematurely gain access to the blood stream, in consequence of the marrow's undue efforts to provide cells with sufficient rapidity to compensate an excessive cell destruction in the body.

The leukocytes undergo no conspicuous deviation in pernicious anemia; their number is generally subnormal, occasionally very much so; and, differentially, there is a lymphocyte increase at the expense of the polymorphonuclear neutrophiles, whose parent cells, the neutrophile myelocytes, tend to invade the circulation in small percentages.

Of the structural degenerations above referred to, those relating to atypical staining proclivities, to granular changes in the cell bodies, and to deformities of size and of shape attract attention, but are not to be regarded as absolutely characteristic of the disease under discussion.

Apart from the blood changes, the pathological condition met with in pernicious anemia is, with certain individual variations, tolerably constant, and, it should be added, entirely discouraging, in so far as any permanent benefit from treatment is concerned. High-grade fatty degeneration of the heart muscle is the rule, and the liver, which shares this change, contains an extraordinarily great excess of iron, especially throughout the middle and external lobular zones. In many cases there is atrophy of the gastric mucosa, perhaps productive of complete destruction of the secreting apparatus, which defect is now thought to represent the effect, rather than the cause, of the anemic condition. Inconstantly, posterior sclerosis of the spinal cord has been discovered. The bone marrow, as already intimated, is similar in appearance to that peculiar to fetal life—replacement of the yellow fatty marrow of the adult by a pultaceous red tissue almost entirely bereft of fat cells and swarming with nucleated red corpuscles, largely of the megaloblastic or embryonal variety. Very rarely the marrow shows none of these evidences of embryonal proliferation, but, on the other hand, is atrophied and

lacking in nucleated elements, and to this peculiar form of the disease the term *aplastic anemia* has been given. Aplastic anemia, it must be emphasized, is not amenable to any known form of treatment, inasmuch as in this grave malady there exist no marrow elements capable of being stimulated into the manufacture of circulating cells—a state of affairs easily recognized by an examination of the blood, which shows a distinctive leukopenia, a moderate number of myelocytes, and very few, if any, nucleated red corpuscles.

The symptomatic details to be coped with in pernicious anemia are referable primarily to the inherent blood poverty, as a consequence of which languor, vertigo, syncope, dyspnea, cardiac throbbing, and great prostration are the striking features of the clinical picture, whose familiar physical signs include blanching of the mucosæ with pallor and lemon-yellow tingeing of the skin; minute hemorrhages in these parts; a soft, full pulse and tumultuous superficial vessels; moderate puffiness of the ankles; great muscular flabbiness and an almost paradoxical preservation of the body weight. To this array it is necessary to add, in numerous instances, obstinate and enfeebling attacks of diarrhea, nausea, and vomiting, plus intractable indigestion persisting stubbornly throughout the greater course of the patient's illness.

Arsenic is the drug that does the most good in pernicious anemia, and although its beneficial effect is convincingly exerted in connection with this grave blood disease, the ultimate results are in no manner comparable with the consistent improvement and spontaneous cure to be looked for from the use of iron in chlorosis. To paraphrase and adapt here my remarks on this topic, it may be said that while virtually no case of genuine pernicious anemia permanently recovers under the use of arsenic, none can improve without it. From which statement one must infer that lasting recovery from this disorder must be considered a most exceptional event, though it is true that now and then an apparently authentic instance is reported in which both the clinical and the laboratory evidences of the anemia have returned to the normal standard and remained so for a period of several years. Hirschfeld¹ has described a typical example of pernicious anemia in which the habitual use of Fowler's solution had insured good health for a period of no less than thirteen years.

Personally, a permanent cure has never come to my notice, and in a rather wide experience the several fictitious recoveries noted have invariably turned out to be merely prolonged remission periods, inevitably, in every instance where it was possible to follow up the course of the illness, attended, sooner or later, by death from the original blood deterioration. Other authors, however, take a more sanguine view of the prognosis. Cabot,² for example, believes that 5 per cent. of all cases ultimately recover. Ehrlich³ gives approximately 1 per cent. as

¹ Therapie d. Gegenwart, 1907, ix, 349.

² Osler and MacCrae's System of Medicine, 1909, iv, 635.

³ Nothnagel's Handbuch, 1900, viii, 300.

the proportion of cases in which permanent recovery takes place. Herbert French's series¹ on analysis afford a recovery rate of somewhat less than 4 per cent. In contrast to these figures should be arrayed von Noorden's surprising statement,² that between 40 and 50 per cent. of all cases of this type of anemia make a permanent recovery; and the recovery figure of Padley, 24 per cent.³

The average lease of life in a subject of Addisonian anemia is not more than a year or two, but occasionally one encounters an individual whose symptoms drag on for years, thanks to repeated and prolonged remissions characterized by a more or less perfect return of health and strength. The amazing duration of such remission periods, which naturally raise false hopes of a cure, is strikingly illustrated by one of Bramwell's patients,⁴ who, after having remained symptomatically well for twelve years, finally relapsed and died of characteristic pernicious anemia thirteen and one-half years after the first attack was observed. Even more remarkable is McPhedran's example of a remission lasting for seventeen years, followed by a final relapse ending fatally.⁵ In the face of such data, what, indeed, can be relied upon as a criterion of actual cure?

Fowler's solution is the form of arsenic best tolerated, and, on the whole, most efficacious in the great majority of individuals who must undergo protracted treatment with this metal, and for this reason, if for no other, its administration in pernicious anemia, therefore, is peculiarly advantageous. Whether the drug should be given persistently in moderate amounts, or whether it should be taken in gradually increasing doses up to the point of toxic saturation of the patient are debatable questions, to be decided mainly by the circumstances prevailing in the individual case. It is my usual practice, in dealing with cases of average severity, to prescribe from 20 to 30 minims of Fowler's solution *per diem*, in three or four equal doses, administered well diluted, after taking food, the patient beginning with a tridaily dose of 2 or 3 minims, and reaching the maximum by increasing 1 minim every third or fourth day. By following this method of treatment the fullest possible benefit from the drug is exhibited, and but rarely is one compelled to suspend its administration on account of the gastric and renal irritation which are so prone to develop when arsenic is pushed more energetically. On the other hand, in fulminant cases (and such are not infrequently encountered) it seems better to use maximal doses, as of from 30 to 40 minims, or even more, daily, which should be worked up to by degrees from an initial prescription not exceeding 5 minims. The hypodermic use of arsenic may be resorted to, in urgent cases, as advised by Chauffard and Laederich,⁶ who recommend for this purpose a 1 per cent. aqueous solution of potassium arsenite with 1.33 per cent. sodium chloride, of which from 6 to 20 drops are given daily,

¹ Albutt and Rolleston's System of Medicine, London, 1909, 2d ed., v, 751.

² Charité-Annalen, 1891, xvi, 217.

³ Amer. Med., 1905, ix, 709.

⁴ Anemia, London, 1899, p. 98.

⁵ Amer. Jour. Med. Sci., 1910, cxi, 261.

⁶ Rev. de méd., 1905, xxv, 653.

by needle, during fortnightly periods separated by a week's interval of rest. Most satisfactory results, with no indications whatever of arsenical irritation, are said to follow this plan of therapy, especially when it is supplemented by systematic feeding with bone marrow (*v. i.*).

Despite all precautions, it is nevertheless true that certain systems rebel at even trifling quantities of Fowler's solution, and this is also true of other arsenical preparations which have been used as substitutes—arsenous acid, arsenate of iron, arsenate of soda, and so forth. In a quandary of this sort, it is sometimes possible to employ one of the arylarsenates, which at least for a time generally will prove helpful, though after prolonged administration there seems to be a decided tendency on the part of these arsenic salts to lose their primary good effects, which peculiarity I have repeatedly noted in the treatment of leukemia (*q. v.*, p. 276). Either sodium anilarsenate (*atoxyl*) or sodium phenylarsenate (*soamin*) may prove a satisfactory choice, the former containing 27.2 per cent. and the latter 22.8 per cent. of arsenic. It is always preferable to give these arylarsenates hypodermically, in doses of from 0.5 gr. to 2 gr. daily for a period of three weeks out of every four, the injections being discontinued during the fourth week, in order to avoid a cumulative action which might produce unpleasant, if not serious, consequences. Acetyl atoxyl (*arsazetin*), one of the least toxic of the arylarsenates, has been employed, with good effects, by Klemperer.¹ Sodium cacodylate and cacodylic acid, though less toxic than the more widely used arsenic preparations, are much less active, and cannot be depended upon as adequate substitutes for such time-tried remedies as either the solution of potassium arsenite or arsenous acid.

Organotherapy, with bone marrow, at one time acquired a certain vogue as a means of combating pernicious anemia which later investigation has failed to justify, and at the present time it is the general tendency of clinicians to attribute any benefit from marrow therapy to the inherent food value of this tissue more than to its reputed action upon living myelogenous structures. Vetlesen² contends that the glycerin vehicle may be the real factor of the favorable results reported in certain patients improved after taking bone-marrow extract, and to support his contention this author cites apparent cures of true Addisonian anemia by the use solely of pure glycerin, given in daily quantities of 12 fluidrams. In the absence of benefit from arsenic, it would seem to be good practice to give bone marrow a fair trial in those cases of pernicious anemia characterized by a well-recognized myeloid blood reaction, by which is meant a persistent moderate percentage of myelocytes in the blood stream, together with a fair proportion of erythroblasts, chiefly of the normoblastic or adult type. In such instances decided improvement in the blood-picture (due to true marrow stimulation?) has been repeatedly observed, notably in the experience of Chauffard,³ Mentrrier,⁴ Ménétrier,⁵ and other of their French contem-

¹ Berl. klin. Woch., 1908, xlv, 2293.

² London Med. Rev., 1909, xii, 157.

³ Rev. de méd., xxv, No. 9.

⁴ Tribune méd., 1905, xxxvii, 245.

⁵ Bull. et mém. Soc. méd. de Hôp., Paris, 1905, xxii, 315.

poraries. Waiving the merits and the demerits of this sort of organo-therapy in profound anemias, it may be pointed out that red bone marrow, obtained from the long bones of the calf, is to be selected by choice, and that the daily ration of this preparation should be not less than two or three ounces. It may be given in the form of delicate sandwiches, as first suggested by Sir Thomas R. Fraser,¹ and thus prepared will not prove unpalatable to the average patient; or a thick, highly seasoned marrow bouillon sometimes is more palatable; or a glycerin extract with alcohol. R. J. M. Buchanan² is accustomed to use a marrow jelly, made of 1 part red marrow and 3 parts of port wine, with the addition of sufficient gelatin and glycerin (about 1 or 2 drams) to obtain a mass of gelatinous consistence. Apropos of marrow therapy in general, two facts stand out pertinently from the mass of somewhat conflicting data: First, that the various glycerin extracts are much less active than the fresh marrow of young calves, which should be selected whenever practicable; and second, that the use of bone marrow is entirely ineffectual in examples of primary anemia associated with atrophic myeloid degeneration approaching, or actually constituting, the aplastic variety.

Transfusion of human blood has been more or less extensively advocated in pernicious anemia, and while isolated examples of brilliant results bespeak a trial of this method of treatment, in selected cases, more often it is followed by no perceptible benefit. Both the arm-to-arm method and the indirect method of introducing defibrinated blood have been employed, of which the former is generally chosen, whenever circumstances permit, despite the difficult operative technique inseparable therefrom. It is, of course, to be understood that the blood of the donor and that of the donee must be proved, by hemolysis tests, to be homologous, before the operation of transfusion is attempted. Theoretically, blood transfusion should help anemia because of the marrow-stimulating and antitoxic properties of the serum transferred from the healthy donor, the amount introduced ordinarily not being more than three or four ounces. Weber,³ for example, resorts to injections of but slightly more than 1 fluidram (5 c.c.) of defibrinated blood, and reports most satisfactory consequences of this small dosage, in seven consecutive cases. Sachs,⁴ on the other extreme of dosage, advocates a single transfusion of approximately 13.3 ounces (400 c.c.); while single injections of from 5 to 6½ ounces (150 to 200 c.c.) are advised by Morawitz.⁵ In neither of the two examples of pernicious anemia in which I have resorted to direct transfusion did the outcome of the operation justify its performance, no lasting improvement being recognizable in either case. In the first the operation had to be abandoned prematurely on account of unavoidable venous clotting in the donee's arm; while in the second the

¹ Brit. Med. Jour., 1894, i, 1172.

² The Blood in Health and Disease, London, 1909, p. 200.

³ Deut. Archiv f. klin. Med., 1909, xcvi, 165.

⁴ Münch. med. Woch., 1908, lv, 437.

⁵ Deut. med. Woch., 1910, xxxvi, 297.

pre- and postoperative blood-pictures were virtually identical, although it was perfectly obvious that the patient's chief clinical symptoms (intractable nausea, emesis, and profound asthenia) improved remarkably within twenty-four hours after operation and have remained so for several weeks since. This patient, a young girl whose blood showed less than 10 per cent. of hemoglobin and an erythrocyte count of 460,000 per. mm., received an arteriovenous transfusion lasting eight and one-half minutes, during which interval her blood pressure rose 20 points (to 92 mm. Hg.), but, unfortunately, without any lasting quantitative and qualitative change in the hemoglobin or the cellular elements. Except in fulminant cases, where one does not hesitate to take any chance, and in those more deliberate forms of the disease, where arsenic fails to do good, it does not appear that blood transfusion, however great may be its utility in certain conditions of acute posthemorrhagic anemia, is adapted as a dependable measure in treating a case of genuine pernicious anemia.

The treatment of pernicious anemia by means of the x -rays has proved, on the whole, of no avail whatever, notwithstanding an occasional report suggestive of better things, as, for instance, the series of 8 cases recorded by Hynek.¹ In this connection mention also should be made of the unique experience of Rénon and Tixier² in treating one case of pernicious anemia by combined x -raying of the femora and the injection of diphtheria antitoxin, at intervals of approximately one week, which régime is declared ultimately to have led to a complete cure. If Mosse's studies³ be correct (and surely clinical facts corroborate them), röntgenization of an embryonal variety of bone marrow must do positive harm, in that the effect of the rays appears selectively to excite megakaryoblastic proliferation—a degenerative process whose inroads are already crippling the hematopoietic functions in the disease.

Great improvement has been noted by Huber⁴ after intramuscular injections of from 10 to 50 c.c. of defibrinated blood.

Cholesterin has been employed, with tolerably favorable results, in the treatment of pernicious anemia, on the presumption that its anti-hemolytic properties, so clearly demonstrated by Reicher,⁵ may retard the active blood destruction which is one of the most striking pathological features of this malady. It is usually administered in a dosage of approximately 30 to 45 grains daily, being given in solution (3 per cent.) with olive oil; in capsules, as advised by Simon,⁶ or, as Klemperer⁷ prefers, in the form of butter and cream, 1 liter of the former and 200 grams of the latter, together containing about 2.2 grams of cholesterin, which is the daily quantity prescribed by this author. Although cholesterin can in no sense be regarded as an efficient substitute for arsenic, it appears to possess a certain value when given as an adjuvant thereto, possibly

¹ *Semaine méd.*, 1906, xvi, 417.

² *Ibid.*, xxiv, 128.

³ *Münch. med. Woch.*, 1907, liv, 16.

⁴ *Deut. med. Woch.*, 1906, xxxvi, 1076.

⁵ *Berl. klin. Woch.*, 1908, xlv, 1838.

⁶ *Jour. Amer. Med. Assoc.*, 1908, li, 2154.

⁷ *Loc. cit.*

because both agents together exert a stronger protective influence upon the integrity of the erythrocytes than either one does when used singly.

The establishment of gastro-intestinal asepsis has been the attempt made in certain quarters, as the fundamental principle of pernicious anemia therapy, and in this endeavor the various so-called intestinal antiseptics, together with mechanical measures, such as gastric lavage and irrigation of the bowel, have been employed, but never with any definite specific results. Such a plan of treatment is unquestionably of value as an aid to the routine administration of arsenic, in suitable cases with prominent gastro-intestinal disturbances, but alone it must fail; nor is it intended to be used as a panacea, even by those who most ardently advocate its utility. Of the long list of pharmaceutical medicaments adapted to the purpose just outlined, the following have received general preference: Bismuth salicylate, salicylic acid, β -naphthol, salol, mercuric chloride, carbolic acid, lactobacillen, and charcoal. For detailed information on the subject of intestinal irrigation in pernicious anemia, the reader is referred to the late reports by Satterlee,¹ Witherspoon,² Houghton,³ and Hollis and Ditman.⁴ Finally, in this connection, note should be taken of William Hunter's plan of treatment,⁵ which consists, briefly, of insuring oral and intestinal asepsis, plus certain subsidiary measures, notably forced feeding and serum therapy, which routine aims to counteract the specific streptococcus infection, to which this author attributes an etiological role.

Iron is of little or no avail in pernicious anemia, a condition characterized by excessive deposits of this metal in the viscera, and in this disease the value of the drug is far inferior to that of arsenic in chlorosis. Phosphorus, quinine, lecithin, nucleinic acid, and oxygen inhalation are among the numerous remedies tried of late years in pernicious anemia, and proved of no real utility.

As to remedial agencies other than drugs, an abundance of fresh air, rest in bed during the asthenic periods, and a richly albuminous dietary should supplement the systematic use of arsenic in treating this affection. Eggs, milk, and red meats, with a liberal supply of fresh fruits and vegetables, constitute an adequate ration, which, of course, must be varied from time to time, according to the exigencies of the individual patient. Hunter⁶ believes in a richly farinaceous diet, on the presumption that too much protein food excites erythrocytolysis.

Of the *special symptoms* which may demand attention, gastro-intestinal disturbances are by all odds the commonest and the most troublesome. In the event of such complications, the physician's first thought instinctively is of arsenic intolerance and of faulty dietary, and if withholding the drug and revision of the diet list do not better things, recourse to some one of the general therapeutic lines already enumerated is indi-

¹ Amer. Med., 1909, xiii, 204.

² Cincinnati Lancet-Clinic, 1909, ci, 346.

³ Jour. Amer. Med. Assoc., 1907, xlviii, 2186.

⁴ Med. Record, 1907, lxxi, 175.

⁵ Pernicious Anemia, London, 1901, Lancet, 1903, i, 283 et seq.; Brit. Med. Jour., 1907, ii, 1299.

⁶ Loc. cit.

cated (see p. 263). The existence of dental caries, ulcerated gums, and a dirty mouth need only to be mentioned to insure their elimination as possible factors of gastro-enteric troubles.

Capillary hemorrhages, seldom of great moment, are occasionally met with, and perhaps call for the employment of the familiar hemostatic agencies. If the bleeding be retinal—and this is not especially rare—it is well to give one of the iodides, preferably the sodium salt, in doses of from 20 to 30 grains daily, to promote absorption of the clot. If the oozing be from the mouth or the nose, the topical application of ice, of adrenalin chloride in 1 to 1000 solution, of glycerite of alum, or of fluid extract of hamamelis will generally be all that is needed. Packing the nares with “adrenalin tape” (sterilized gauze strips charged with a 1 to 2000 adrenalin chloride solution) is a clean, simple, and efficacious way of controlling a troublesome nose-bleed.

If there be blood in the stools, temporary withdrawal of all food, iced compresses to the belly, and the prescription of suitable styptics that will act upon the mucous surfaces are good practice, provided that the hemorrhage comes from the upper part of the bowel. Thus, a pill of lead acetate (1 gr.), camphor (2 gr.), and opium ($\frac{1}{4}$ gr.) is excellent; or Monsel's salt of subsulphate of iron may be given, in 3-grain salol-coated pills, so as to reach the intestine undissolved, as advised by H. A. Hare.¹ For the control of bleeding within reach of a rectal injection one may select enemas of iced water, of alum (2 per cent.), of tannic acid (2 per cent.), of Monsel's solution (5 per cent.), of argyrol (0.5 per cent.), or of silver nitrate ($\frac{1}{5}$ per cent.). Hematemesis, which is unusual, is to be treated on general principles—local cold, rectal feeding, and the exhibition of astringents of the gastric mucosa, like silver nitrate ($\frac{1}{4}$ gr.); albuminate of tannin (15 gr.); Monsel's solution (3 minims); 1 to 1000 adrenalin solution (1 dram); or the lead-camphor-opium pill just named. For the same purpose the administration, by mouth, of sulphuric acid or of turpentine, each in doses of from 5 to 10 minims, sometimes is sufficient. In addition to the foregoing, every hemorrhagic patient must have perfect physical rest and mental calm, and, if it be deemed worth while, a trial of those erratic drugs reputed to repair deficient blood coagulability.

Exceptionally the patient complains bitterly of certain sensory disturbances, such as painful muscular cramps, lancinating pains in the arms and legs, and lightning-like pains, like those of locomotor ataxia, which may arise as isolated symptoms or in connection with a clinical picture of tabes. In these contingencies the application of a snugly fitting flannel bandage, with rest and elevation of the painful limb, and the judicious use of anodynes are helpful.

¹ Practical Therapeutics, Philadelphia, 1909, 13th ed.

SPLENIC ANEMIA.

The morbid condition known as splenic anemia cannot be regarded as a clinical entity amenable to ordinary therapeutic measures, and the average case history of this affection, uninfluenced by drugs and other pharmaceutical resources, sooner or later undergoes developments which by contrast obscure the primary manifestations of the anemia and strikingly dominate the clinical picture. It is quite impracticable to suggest, even in outline, a plan of purely medical treatment for a case of splenic anemia. In its incipient stages the condition to be remedied is seemingly, though not actually, simple: splenic enlargement plus anemia of a secondary type with leucopenia, and at this stage of the malady one naturally is inclined to prescribe iron and arsenic and a nutritious dietary, together with the observance of the regimen adapted to the treatment of a usual case of secondary anemia. But if such a plan be followed, sooner or later it must fail, for the initial splenomegalic anemia tends gradually to become aggravated, signs of progressive asthenia supervene, and in those subjects affected with a typical form of the disease the liver cirrhotically enlarges, permanent icterus appears, and the abdomen fills with fluid. Thus develops the terminal symptom complex commonly referred to as Banti's disease, in which condition it is obviously futile to attempt more than to use palliative measures that may ease the patient's suffering during the last days of his now brief lease of life. It is true that of the 25 medically treated cases collected by Lichty,¹ 5 are said to have recovered, but this figure should be accepted with due allowance for diagnostic errors and for premature final decisions in the individual instances reported. So much for purely medical treatment, which in the entire history of splenic anemia, from its beginning as a splenomegalic anemia to its end in the guise of Banti's syndrome, offers little as a means of arresting its progress.

Surgical interference, on the contrary, promises a radical cure in many cases, and the earlier it is resorted to the more hopeful is the outlook therefrom. Conservatively speaking, splenectomy performed during the preascitic stage of splenic anemia saves fully 25 per cent. of those who otherwise would inevitably die, and even after the onset of hepatic enlargement and ascites removal of the spleen promises a prolongation of life. In the face of these grave developments Tansini² has successfully supplemented splenectomy by creating adhesions between the liver, the omentum, and the abdominal wall, after the manner devised by Talma. Armstrong's report³ shows a mortality of 28 per cent. for a series of 32 cases subjected to splenectomy, or, in other words, 23 recoveries and 9 deaths. Almost invariably the patients designated as recoveries were wholly restored to health, their convalescence being attended by a rapid disappearance of the postoperative anemia and leukocytosis,

¹ Jour. Amer. Med. Assoc., 1904, xlii, 528.

² Rif. med., 1902, xviii, 3.

³ Brit. Med. Jour., 1906, ii, 1273.

by clearing up of the jaundice and pigmentation, and by a restoration of the liver to its natural size. As to the permanency of the cure of this type of anemia by removal of the spleen, Osler¹ cites an instance in which the patient's health remained good for almost ten years after the operation, antedating which there had been splenic enlargement for twelve years. Armstrong² instances one recovery of eight years' standing, one of seven years, and one of six and one-half years. The post-operative blood changes which arise after excision of the spleen in the malady under discussion do not differ essentially from those noted after splenectomy performed for other diseases of the organ, these changes, in brief, consisting of a transient and moderate oligocythemia with a temporary leukocyte increase characterized by large-celled mononucleosis and attended, inconstantly, by a more or less persistent eosinophilia. The pre- and postoperative blood pictures incident to splenectomy in this disease have been carefully studied by a number of investigators, notably by Lewis³ and by Bierring and Egdahl,⁴ whose contributions to this subject contain a full digest of the literature pertaining to the subject. That the knife should succeed where drugs avail nothing permanent is perfectly conceivable, if Banti's conception of the affection bearing his name be accepted, by assuming the lesion to be a chronic infection mainly affecting the spleen and secondarily generating a toxemia which produces extensive hyperplasia of this organ's endothelial structures, excites blood destruction, and induces hypertrophic cirrhosis of the liver and all of the unfortunate issues thereto consequent. Untreated, splenic anemia, according to Einhorn, passes through a primary stage of splenic enlargement and anemia, lasting from one year to four and one-half years; an intermediate stage of hemorrhages, urine suppression, and diarrhea, conspicuous for but a month or so; and a terminal stage of hepatic cirrhosis and ascites, of approximately six weeks' duration. To the foregoing very general summary, however, there are numerous exceptions, for it is by no means unusual to meet with splenic anemia of many years' duration.

Notwithstanding several reports of cases improved by röntgenization, the efficacy of the *x*-rays in benefiting splenic anemia has not been convincingly demonstrated.

LEUKEMIA.

Just as iron is curative in chlorosis and as arsenic is helpful in pernicious anemia, so are arsenic and iron in combination indispensable in dealing with leukemia, the former drug in some manner appearing to restrain the undue leukocytic proliferation incident to this disease and the latter to some extent counteracting the attendant anemia. This leukemic anemia, it should be emphasized, is a most important feature of the symptom complex, and deserves quite as careful attention as

¹ Brit. Med. Jour., 1908, ii, 1154.

² Amer. Jour. Med. Sci., 1908, cxxxvi, 157.

⁴ Jour. Amer. Med. Assoc., 1906, xlvii, 1149.

³ Loc. cit.

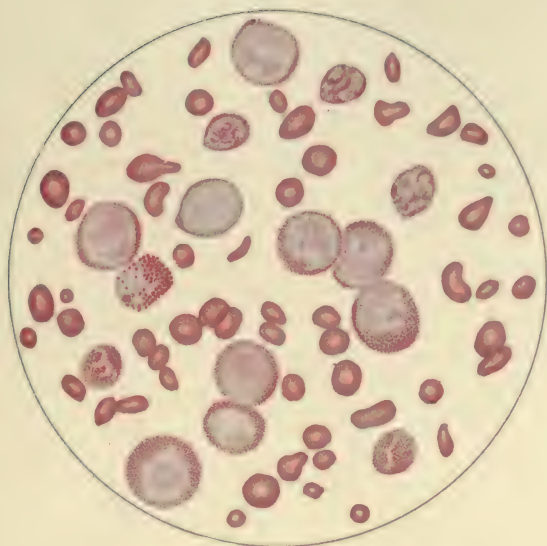
does the more dramatic behavior of the abnormal leukocyte picture. Radiotherapy supplements, if not supplants, the action of arsenic and iron, and sometimes the x -rays alone are sufficient to arrest, at least temporarily, the most prominent features of a leukemic process.

Here again does Fowler's solution prove, in the long run, the most dependable preparation of arsenic for routine administration, but, unfortunately, here again must one anticipate toxic symptoms from its prolonged use and be prepared absolutely to prohibit the drug in certain individuals, whose personal idiosyncrasy forbids its use. Every clinician is able to recall more than one of those discouraging instances in which the onset of diarrhea, gastric distress, and edema compelled the discontinuance of the Fowler's, perhaps just at the very time the leukocyte count was falling normalward and the subject's splenomegaly becoming less of a burden. It is a well-justified empiricism that thorough saturation with arsenic offers real hope of improving a leukemic condition, and, by the same token, of reducing the size of the enlarged spleen, which, in most of the myelogenous cases, is a source not only of pain, but also of considerable mechanical discomfort from upward pressure against the left phrenic dome and from encroachment upon the contents of the abdominal cavity.

Provided that the subject is not hypersusceptible, the daily dose of Fowler's solution, initially from 3 to 5 minims, can be pushed rapidly, by increasing 1 minim over the preceding dose on alternate days, to the point of tolerance, which in some individuals means an amazingly large daily intake of the drug. It is not at all exceptional to be able to give as much as from 45 to 60 minims during each twenty-four hours, although ordinarily about 30 minims a day is the maximum amount that can be taken without causing trouble. It is in this last group of cases, as well as in those who are utterly unable to do well on Fowler's solution, that the arylarsenates fulfil a useful purpose, and their adoption under these conditions is to be advised as sound therapy. If atoxyl be chosen, the most adequate effects from its use attend its administration, hypodermically, according to some definite plan, such as the following, which divides the course of treatment into weekly periods, thus: *First week*, 0.5 grain daily; *second week*, 1 grain daily; *third week*, 2 grains daily; and *fourth week*, injections suspended. By the foregoing routine, which I have employed in leukemic cases during the past two years, the beneficial action of the drug can be actively enlisted, without the fear of toxic consequences therefrom, either arising directly, or by an accumulative route, which the fourth week without atoxyl seems effectually to prevent. The patient thus receives a total of $24\frac{1}{2}$ grains of the sodium anilarsenate during three weeks' time, and, after a rest of seven days, repeats the régime in the same manner for another three weeks' period, which may be repeated again, according to the prevailing circumstances. At first, both atoxyl and soamin tend to lower the high leukocyte count and to diminish the percentage of myelocytes, mast cells, and other pathological leukocytes, but neither of these arsenic salts appears to exhibit this initial effect after a certain point is reached. This point, in

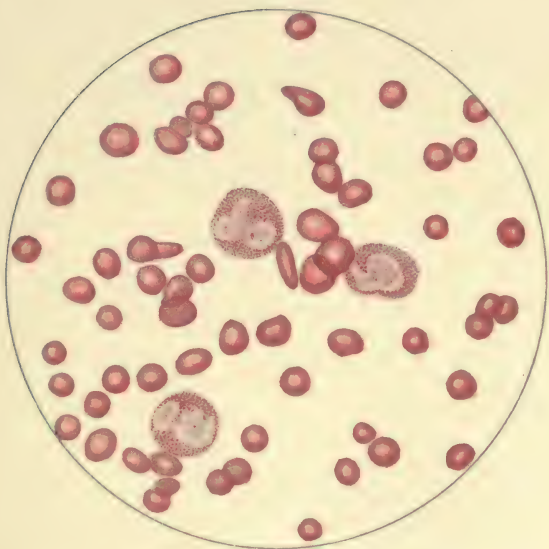
PLATE X

FIG. 1



Before treatment

FIG. 2



After forty-two weeks' treatment with atoxyl and x-rays.

Blood Films from a Case of Myelogenous Leukemia.

my own experience, is always attained before even an approximately normal leukocyte level is distinguishable, and continuance of the atoxyl injections after this time does no further good whatever (though apparently no toxic symptoms supervene), nor is there any improvement of the blood-picture or of the other symptoms. But now, if Fowler's solution be prescribed in small daily doses (15 to 30 minims), an immediate decline in the number of leukocytes, with coincident diminution of the splenic tumor, is the usual outcome, which in the exceptional example of myelogenous leukemia may prompt one's belief in the possibility of a symptomatic cure.

Iron should be used with a free hand in leukemia, in the attempt that must be made to offset the striking hemoglobin and erythrocyte deficiencies so intimate a part of this grave disorder's symptomatology. Bearing in mind the fact that leukemia is essentially a myeloid hyperplasia closely related to, if not part and parcel of, a malignant process, it can be readily understood how necessary it is to combat the concomitant anemia, which, of itself, represents a morbid lesion of great severity. This blood defect, briefly, can be attributed mainly to at least three factors—inadequate hematopoiesis, by fault of the leukemic invasion of the bone marrow; hemolysis, from the action of circulating toxins; and interference with the normal absorption and assimilation of food.

As a rule, a leukemic hemoglobin anemia is more intense in the lymphatic type of the disease than in the myelogenous, and, irrespective of the type of the disease, tends to reach a higher grade in acute than in chronic cases. Of 60 myelogenous cases of my series, the average hemoglobin loss was 52 per cent., and the average erythrocyte deficiency, 48 per cent. of the normal standard. By contrast, 62 per cent. was the average hemoglobin loss, and 40 per cent. the average erythrocyte deficiency, in 24 examples of lymphatic leukemia. Probably the most conspicuous single feature of a leukemic anemia is the frequency with which the blood-picture corresponds to a normoblastic type, which, as the disease runs its course, tends with tolerable fidelity to revert to a megaloblastic form, though it is too much to state that a genuine fetal blood-picture, like that so common in Addisonian anemia, develops.

It matters but little what form of iron is given to a leukemic, so long as the chalybeate selected is a well-tolerated and efficient hemoglobin builder. These two essentials are all important, inasmuch as in giving iron to the average case of leukemia one must persevere for a prolonged period, in the endeavor to restore a lagging hemoglobin content to a level more nearly commensurate with the erythrocyte figure, which tends to approach normal the more readily of the two. Ferratin, in doses of from 15 to 30 grains daily, admirably fulfils the foregoing essentials, and usually can be taken for indefinite periods, even by patients prone to suffer gastric irritability and constipation from the action of other iron preparations. The same is true of iron carbonate, save for its tendency, in certain cases, to lock up the bowels when taken continuously for weeks at a time. None of the other iron salts referred to in the preceding

pages appears to offer advantages superior to those of the two just mentioned.

In the myeloid type of leukemia the therapeutic value of the x -rays now merits even greater confidence than that of arsenic, and deservedly so, for röntgenization, when skilfully done, reaches the true root of the lesion more surely than does blind drugging. It has been clearly proved, notably by Curschmann and Gaupp,¹ by Linser and Helber,² and by Stengel and Pancoast,³ that the exposure of leukemic tissues to the x -rays results both in direct destruction of the leukemic cells (especially the myelocytes and the large mononuclear leukocytes) and in the generation of leukocytolytic toxins which, liberated, circulate systemically, and in so doing are carried to other foci of leukemic cells out of reach of the rays' direct influence, and in consequence these cells also suffer a toxic disintegration. That these toxins are capable of injuring parenchymatous structures is suggested by Morse,⁴ who found at autopsy advanced (toxic?) hepatic cirrhosis in an example of lymphatic leukemia long subjected to röntgenization. Moreover, there are good grounds for assuming that the effect of the rays may also lessen the development of leukocytes, and, indeed, may even produce an aplastic change in the hematopoietic tissues, according to the researches of Lossen and Morawitz.⁵

In undertaking to röntgenize a leukemic patient two chief precautions are to be observed, namely, the destruction of but moderate numbers of leukemic cells at each sitting, so as to eliminate, so far as possible, the lighting up of severe systemic reactions consequent to the liberation of an excessive amount of leukocytotoxins; and the avoidance of skin burns from repeated exposure of a single area to the action of the rays. By-effects of this sort are best evaded by mapping out the surface of the body, over the long bones, the spleen, and the superficial glands, into several exposure areas, upon which the x -rays are focussed in rotation, according to a prearranged plan which embraces exposures ranging in time from five or ten to twenty minutes, and in frequency from tri-weekly to daily séances. Maragliano particularly advises exposures, not only of the liver and spleen, but of the glandular regions of the neck, and in order to avoid the burns ordinarily attending the x -raying of such large surface areas, he makes use of a covering of lead plaster, to filter out the irritant and therapeutically valueless rays without interfering with the penetration of the curative rays. For the same purpose sheet silver is preferred by von Jaksch as a protective shield. Röntgenization should never be pushed too fast, for fear of exciting a general reaction and of aggravating the already enormous leukocyte proliferation, in view of which danger it is best to make the initial exposures of brief duration and at infrequent intervals—details obviously to be decided by

¹ Münch. med. Woch., 1905, lii, 2409.

² Verhandl. d. Kong. f. inn. Med., Wiesbaden, 1905, xx, 143.

³ Jour. Amer. Med. Assoc., 1908, 1, 1317.

⁴ Boston Med. and Surg. Jour., June 29, 1908.

⁵ Deut. Arch. f. klin. Med., 1905, lxxxvi, 217.

the peculiarities of the individual case. Particularly in subjects of renal disease is it necessary, say Musser and Edsall,¹ to use great caution to avoid the stimulation of autolytic processes.

To sum up its utility, radiotherapy may be regarded as a means of arresting a large proportion of the early cases of chronic myelogenous leukemia and of distinctly improving the condition of the advanced ones; it does harm about as frequently as good in both of the acute types of the disease, and in the chronic lymphatic form it is of but little avail. No definite cures can be attributed to this means of therapy, but of the numerous treated cases now on record the large majority have shown a greater or less (happily a greater) degree of improvement, as in 40 per cent. of Grawitz's 41 myelogenous cases;² in 90 per cent. of de la Camp's 25;³ and in 90 per cent. of the series of 38 cases collected by Wendel.⁴ In but 1 of the group of 15 lymphatic leukemias treated by Grawitz⁵ was improvement observed. Pancoast's data⁶ are an interesting commentary on the ultimate outcome of radiotherapy—4 out of 63 cases (6.35 per cent.) alive and well three to six years after symptomatic cure.

The therapeusis of leukemia, as in other incurable maladies, is burdened with a long list of reputed remedial measures, none of them curative, few helpful, and many fanciful. Dismissing the first and last groups, there remains a number of helpful methods other than those already discussed whose utility is sufficiently established to merit at least a brief descriptive notice, in the interpretation of which, however, the reader is hereby cautioned not to confound selection with election.

The injection of *bacterial toxins* has been tried in the treatment of leukemia, chiefly because of the numerous reported examples of the disease in which some intercurrent infection has apparently produced a temporary abeyance of the leukemic process. On the presumption that the deliberate introduction of bacterial toxins, in measured doses, should act similarly, Larrabee,⁷ employing Coley's fluid (mixed streptococcus and prodigious toxins), obtained encouraging results, with one symptomatic cure, in 3 myelogenous cases, but noted no improvement in a single case of lymphatic leukemia. Daily injections were given, beginning with doses ranging variously from $\frac{1}{16}$ to $\frac{1}{10}$ drop, and increasing each successive day by the amount of the initial dose, until a reaction occurred, the maximum dose at this time varying from $\frac{1}{4}$ drop to as much as 6 drops. Bacterial toxins also have been used, with fair success, by Baldauf⁸ in myelogenous, but not in lymphatic, leukemia. In undertaking this kind of therapy, extreme care is to be observed, by careful regulation of the dosage and of the inoculation intervals, not to excite severe systemic reactions, as evidenced by hard chills, great prostration,

¹ Univ. of Penna. Med. Bull., 1905, xviii, 174.

² Verhandl. d. Berl. med. Gesellsch., 1909, xxxix, 162.

³ Therapie der Gegenwart, 1905, xlv, 119.

⁴ Münch. med. Woch., 1905, lii, 156.

⁵ Progressive Med., 1907, ix, 286.

⁷ Boston Med. and Surg. Jour., 1908, clviii, 183.

⁸ St. Louis Med. Rev., 1909, lviii, 113.

⁶ Loc. cit.

and exaggeration of the leukemic blood-picture. Judging from the foregoing experiments, the application of vaccine therapy (using heat-killed cultures) in treating leukemia would seem warranted as a possible source of improvement, and one entailing neither discomfort nor danger to the subject. Thus far little or no success has attended the use of *tuberculin injections* in leukemia, as tried by Weitz,¹ Heuck,² and others—possibly, as Dock's remarks suggest,³ because concurrent tuberculosis in a leukemic does not modify the latter disease, as does an intercurrent streptococcemia, for example. Disappointing results have followed the injection of formalin by Bailey,⁴ of cinnamic acid by Richter,⁵ of alien leukemic serum by Capps,⁶ and of splenic extract by Jacob.⁷

Splenectomy as a means of controlling leukemia is mentioned only to be condemned. Notwithstanding the views of those who would use the knife and the needle, there is great truth in the sentiments of von Leube,⁸ who believes "that the time has come to discontinue all efforts to cure the disease by injections . . . into the spleen, by faradization or galvanopuncture of the organ, by extirpation of the glands, or by splenectomy."

"Direct transfusion of blood cannot modify the clinical picture of this disease," states Crile of leukemia.

A legion of special symptoms is not unlikely to arise during the course of leukemia, and of these complications, gastro-intestinal disturbances, cardiac distress, and dropsy are the most conspicuous and frequently so stubborn as to defy all efforts devised for their amelioration. Hemorrhage, commonly from the bowel or from the nose, is a troublesome symptom which arises in a fair proportion of leukemics, especially in those of the acute lymphatic type, while in all, sooner or later, loss of flesh, utter distaste for food, extreme cachexia, and progressive asthenia, ultimately amounting to grave prostration, rule the clinical picture. In the myeloid variety of leukemia an enlarged spleen is commonly the cause of considerable pain and of interference with the functions of the heart, the lungs, and the intestines; and in the lymphatic type of the malady the presence of numerous groups of enlarged lymphatic glands accounts for great discomfort. Obviously, nothing radical can be done to alleviate these distinctively leukemic symptoms, dependent as they are upon ineradicable structural changes, other than consistently to carry out a carefully planned arsenic-iron-*x-ray* regimen.

Of the *gastro-intestinal symptoms* associated with leukemia, harassing and obstinate diarrhea is the most troublesome, for its control is always difficult and sometimes impossible. Diarrhea from a gut infiltrated with leukocytes, filled with swollen lymphoid follicles, or perhaps stippled with ulcers cannot be expected to yield to therapeutic methods ordi-

¹ Deut. Archiv f. klin. Med., 1908, xcii, 551.

² Deut. med. Woch., 1891, 746.

³ Amer. Jour. Med. Sci., 1904, cxxvii, 563.

⁴ Cited by Grawitz, loc. cit.

⁵ Jour. Exper. Med., 1907, ix, 51.

⁶ Modern Clinical Medicine, New York, 1906, 368.

⁴ Lancet, 1906, ii, 1654.

⁷ Cited by Grawitz, loc. cit.

narily adequate in the management of a simple intestinal catarrh. If drugs used for this purpose be given a trial they should be supplemented by full doses of opium and by frequent irrigation of the bowel with some one of the solutions used in intestinal hemorrhage (see p. 273). Rest in bed, a restricted predigested diet, and the administration of pancreatin, diastase, and lactobacillary products are helpful, but not curative, measures not to be neglected. Anorexia, nausea, vomiting, and like symptoms referable to the digestive tract are to be handled according to general principles.

Cardiac disturbances, if due to splenic pressure, are best relieved by the use of a bed rest and by the avoidance of a recumbent posture. If, on the other hand, there exists an actual cardiac lesion, such as fatty change in the musculature, strychnine and strophanthus are indicated, and also digitalis, provided that the hypertension thereby set up is not too severe a stress upon the weakened heart muscle. Syncope and attacks of labored breathing, which are of very common occurrence, can usually be relieved by some one of the diffusible stimulants, as, for example, aromatic spirits of ammonia, camphor, or Hoffman's anodyne.

Dropsy in a leukemic subject is variously to be interpreted, according to the nature of the responsible factor, which should be identified, if possible, so as to prescribe for this symptom intelligently. In the majority of instances the dropsy is purely of an anemic character, and therefore requires no other therapy than that planned to overcome the underlying blood disorder. In these cases, bogginess of the ankles and the legs is the patient's chief complaint, which can be greatly alleviated by the firm application of a soft flannel roller bandage. Cardiac dropsy (by no means a common development) is treated along the familiar lines of cardiovascular stimulation, unnecessary to recount in this place. In the event of ascites arising in consequence of venous obstruction from the pressure of an enlarged spleen, relief may be afforded by supporting the belly with a tight binder and by insistence upon the patient's remaining in the left dorsolateral decubitus, or semidecubitus. Hydragogue cathartics, in that they may provoke serious diarrheal trouble, should never be employed to drain away abdominal fluid in a leukemic, nor is it safe to use a trocar for this purpose.

Spontaneous hemorrhages, less frequently met with in chronic myelogenous leukemia than in the more acute lymphatic form, generally can be controlled by the measures mentioned in the discussion of this phase of pernicious anemia. As a rule, such accidents amount to nothing more serious than a free epistaxis or a bleeding from the gums; less commonly, the blood comes from the kidneys, the lungs, or the cerebral bloodvessels. The limited cachectic purpura of advanced leukemia, as well as the larger extravasations sometimes occurring in the acuter stages, are not amenable to any special therapy.

Apart from the plan of treatment above recounted, the leukemic subject must be induced to conserve his waning strength by rest; to partake of as full and nutritious a diet as the diseased alimentary canal will tolerate; and to live as much as possible in the open air and sunshine.

But despite these precautions, which at the most are but tentative, the time ultimately must come when the inroads of the leukemic process reach a stage that makes bedridden invalidism the only promise of the future, and now the palliative measures, previously of some avail, must needs prove absolutely futile, while the patient's last days are calmed by the liberal administration of a merciful opiate. Such a crisis looms up within three years after the first symptoms are noticed, in the average case of so-called chronic leukemia; and perhaps within a few weeks, in examples of acute leukemia.

CHLOROMA.

This rare and fatal leukemic disease is entirely beyond the reach of therapeutic influence, the average patient surviving for but about six months after the appearance of the characteristic leukoblastic growths and the appearance of the acutely lymphatic (rarely myeloid) blood changes. That no known method of treatment can arrest, much less cure, this morbid bridge between true leukemia and lymphosarcoma is but natural, in the face of the widespread neoplastic lesions which invade the osseous structures and infiltrate the viscera and glands. Drugs, nor the knife, nor the *x*-rays avail nothing, and in consequence the medical adviser's efforts are of necessity restricted to the palliation of whatever urgent symptoms arise.

INFANTILE PSEUDOLEUKEMIC ANEMIA.

The affection commonly known as infantile pseudoleukemic anemia, though a doubtful clinical entity, occurs in the dress of a symptom group the very complexity of which is sufficient to enlist the therapist's attention. Enlargement of the spleen, of the liver, and perhaps of the superficial lymphatics; extreme emaciation, pallor, and cachexia; and a blood-picture of secondary anemia with well-defined leukocytic polymorphism are the leading hall-marks of this obscure malady, variously termed von Jaksch's "*Anemia infantum pseudoleukæmica*" by the Germans,¹ "*Anemia splenica infettiva die bambini*" by the Italians,² and "*Infantile splenic anemia*" by the English.³

In the management of this condition it is helpful to recall the fact that a history of congenital syphilis can be established in a tolerably large proportion of cases, that others are rachitic, and that some are tuberculous. The precise relation of these processes to infantile pseudoleukemic anemia is still an open question, but their co-existence, whether it be causal or concomitant, cannot be disregarded, from the standpoint

¹ Von Jaksch, *Wien. klin. Woch.*, 1889, ii, 435 et seq.

² Di Lorenzo, *Arch. ital. di pediat.*, 1890, viii, 175.

³ R. Hutchinson, *Lancet*, 1904, et seq.

of practical therapeutics. Prolonged suckling is another possible, even most probable, factor upon which considerable stress is laid by British authorities, as, for example, by Robert Hutchinson,¹ who attributes to this custom among the Polish Jews of the London slums the undue prevalence of pseudoleukemic anemia in children of this race.

The treatment of infantile pseudoleukemic anemia does not differ radically from that of an ordinary secondary anemia, in so far as it concerns the administration of iron and arsenic and in the observance of appropriate dietetic and hygienic rules. Cod-liver oil, as a supplement to the hematinics, is of value especially in rachitic and miasmatic infants, while in those tainted with lues mercurial inunctions are indicated. Diarrhea, often a prominent and persistent complication, requires attention along established lines, of which the adoption of a bland, pre-digested diet and irrigation of the gut are particularly serviceable. Intercurrent infections are to be carefully guarded against, inasmuch as accidents of this sort account for more deaths than are referable to the anemia itself, which can be arrested, according to Rotch,² in fully 80 per cent. of cases.

ERYTHREMIA.

The curious syndrome, erythremia, or, to use a more clearly descriptive term, splenomegalic polycythemia, which was first described by Vaquez³ and later given an undeniable clinical status by Osler,⁴ can be relieved by certain methods of treatment, though a cure, in its literal sense, is not to be expected, for factors are at work that keep up, in all likelihood as a permanency, a hyperfunctioning of the bone marrow that at the present time is believed to be uncontrollable. In the management of a case of erythremia the principal indication is for the relief of the extraordinary vascular congestion, so plainly betrayed by the subject's deep cyanosis, difficult respiration, enlarged spleen, proneness to spontaneous hemorrhages, and cerebral symptoms such as headache, vertigo, and, occasionally, signs of intracranial hemorrhage. In intimate correlation with these objective findings, the blood shows distinctive alterations, consisting in the main of hyperviscosity, enormously high hemoglobin and erythrocyte values, and, usually, leukocytosis of the typical polymorphonuclear variety. Venesection is the logical treatment for such a condition, and this operation, which may be resorted to repeatedly, according to the demands arising in the individual instance, usually affords temporary relief to the sufferer, though it has no permanent curative action. With the latter as a goal, röntgenization, after the manner employed in leukemia (*q. v.*), has been tried, with fair success, in bettering the patient's general condition and in modifying the splenomegaly and the excessive hemoglobin and erythrocyte figures. This

¹ Allbutt's System of Medicine, London, 1907, 2d ed., v, 782.

² Pediatrics, Philadelphia, 1901, 3d ed., p. 889.

³ Bull. Soc. méd. des hôp., Paris, 1899, xvi, 579.

⁴ Amer. Jour. Med. Sci., 1903, cxxiv, 187.

is the experience of Aldrich and Crummer,¹ of Tooth,² and of several London clinicians referred to by F. Parkes Weber,³ whose personal opinion of the rays' influence is not unequivocally favorable. The iodides, because of their action in lowering blood viscosity, have been recommended by Hirschfeld⁴ as a suitable remedy to alleviate this erythremic defect, and with the same purpose in view various investigators have advised oxygen inhalations—but with disappointing results. Begg and Bullmore⁵ speak well of the use of quinine and of iodide of mercury ointment. Among the list of various remedies which have failed to benefit the disease, quinine, arsenic, sodium nitrite, and thyroid gland are worthy of note. Iron and other hematinics are, of course, contraindicated, and this proscription also applies to the vasodilators as a class, and, as Weber points out,⁶ to the coal-tar products. It seems good practice, aside from choosing some one of the therapeutic procedures just mentioned, to carry out Stern's suggestion⁷ of enforcing a virtually iron-free diet, and also to advise the liberal use of some reliable lactobacillary preparation of milk. Removal of the spleen has invariably proved fatal in erythremia, according to current data, represented by the reports of splenectomies by Schneider,⁸ Axel,⁹ and Cominotti.¹⁰

¹ Jour. Amer. Med. Assoc., 1907, xlviii, 1163.

² London Clinical Jour., 1907, xxix, 286.

³ Quart. Jour. Med., 1909, ii, 85.

⁴ Berl. klin. Woch., 1907, xlv, 1302.

⁵ Edinburgh Med. Jour., 1905, xvii, 481.

⁶ Loc. cit.

⁷ Wien. med. Klinik, 1908, iv, 43 et seq.

⁸ Wien. klin. Woch., 1907, xx, 413 et seq.

⁹ Folia Hematolog., 1905, ii, 685.

¹⁰ Wien. klin. Woch., 1900, xiii, 881.

PART III

THE TREATMENT OF DISEASES OF THE DIGESTIVE SYSTEM AND ALLIED ORGANS

DISEASES OF THE MOUTH AND SALIVARY GLANDS, INCLUDING MUMPS. DISEASES OF THE STOMACH. DISEASES OF THE INTESTINES, EXCLUDING OBSTRUCTION, BUT INCLUDING THOSE DISEASES OF THE RECTUM WHICH CAN BE TREATED BY MEDICINAL MEASURES

BY JOSEPH SAILER, M.D.

DISEASES OF THE MOUTH.

THE therapeutics of buccal disease is in a comparatively unsatisfactory state, notwithstanding the ease with which the mouth can be inspected, its secretions tested, and the remedies applied.

In this section I shall include the treatment only of the various forms of stomatitis, the disturbances of the salivary glands, and pharyngitis. I shall not include the treatment of those disturbances of the buccal cavity that have their origin in the central or peripheral nervous system, nor the treatment of the benign or malignant tumors that occur in this region.

STOMATITIS.

Under the term *stomatitis* is included a considerable number of mild infectious and irritative processes, most of which are self-limited, or depend upon the withdrawal of the causal factor for a cure. Rarely can they be regarded as more than minor ills, although in a number of them a considerable degree of discomfort is produced. Sometimes they are manifestations or complications of some graver process.

Acute Catarrhal Stomatitis.—Acute catarrhal stomatitis has a variety of causes. It occurs in many forms of infectious diseases, such as scarlet

fever, measles, smallpox, etc., and as a result of irritation by hot substances, chemicals, exposure to hot gases, particularly steam, and certain forms of dust. The prophylaxis varies with the cause. Cleanliness of the mouth seems to benefit the milder forms. For those exposed to irritating dust a simple gauze mask mounted on a wire frame and covering the mouth and nose is usually all that is required. There is no prevention for the forms of stomatitis associated with the acute infectious diseases, but cleansing the mouth with mild antiseptics usually renders them less severe. For this purpose a wash containing boric acid, and, if the pain is severe, a very small amount of carbolic acid, is efficient. A weak Dobell solution is also very satisfactory. If there is much pain and subjective heat the patient obtains great relief by holding pieces of ice in the mouth until they melt. In the more severe infectious cases potassium chlorate still maintains the favor of the profession, although I have frequently seen temporary renal irritation follow its use, and it should be administered with great caution. It may be given either in solution or in troches, and I believe that it is not safe to exceed 20 grains in the course of twenty-four hours. Potassium permanganate may also be employed. It should be used solely as a wash, the patient rinsing the mouth with it, or, what is better, the mouth should be carefully washed with a small glass syringe, the solution injected between the gums and cheeks underneath the tongue. The strength of the solution may vary from 1 to 10,000 up to 1 to 2000. If there is any tendency to suppuration a dilute solution of peroxide of hydrogen may be employed. Not infrequently the internal administration of salicylates appears to do good, but if there is no relief from their administration within twenty-four hours they should be discontinued.

Ulcerative Stomatitis.—Ulcerative stomatitis may be treated by these measures, and, in addition, the ulcers touched with nitrate of silver, using either a 5 to 20 per cent. solution or the solid stick.

Chronic Stomatitis.—Chronic stomatitis is more frequently the result of some intoxication than of local infection. It may also occur in the course of uremia, tabes, and in states of profound cachexia. Ulceration is common, and there are certain characteristic signs that in some forms render the diagnosis easy. The necessity of the removal of the cause, if it can be discovered, is so obvious that it need hardly be mentioned.

The local treatment consists of scrupulous cleanliness and washes containing a mild antiseptic or potassium chlorate. If there is much pain a mild local anesthetic, such as menthol or a weak solution of carbolic acid, may be employed. Caustics, particularly a solution of zinc salts, may be applied to the ulcers, but the results of their application are by no means brilliant. In many cases of *lead stomatitis* it is also desirable to give saline laxatives, and there seems to be a general agreement that iodides promote elimination.

Of the specific forms of stomatitis the *thrush* occurring in children is treated by cleanliness and alkaline mouth washes, particularly solutions of bicarbonate of soda.

Diphtheritic Stomatitis.—Diphtheritic stomatitis usually yields to the injection of antitoxin without local treatment. As local measures, peroxide of hydrogen, chlorine water, and extract of pancreas may be used.

Gangrenous Stomatitis.—Gangrenous stomatitis is commonly a fatal complication of some infectious disease. Locally the gangrenous area should be thoroughly cauterized either with the actual cautery or a powerful mineral acid. The patient should be given a nutritious diet, and stimulants may be required. As the diphtheria bacillus is occasionally found associated with this form, diphtheria antitoxin should also be employed at once without waiting for the result of a culture, for the rapid spread of the disease and the resulting deformity, if the patient should recover, render it imperative to check the process at the earliest possible moment.

The most important specific infections, *syphilis* and *tuberculosis*, are benefited chiefly by general treatment. If tuberculous ulceration of the tongue occurs and is painful the ulcers may be treated by local applications of dilute carbolic acid or solutions of cocaine or eucaine. The local application of lactic acid has also been advocated. I have found that a solution of potassium permanganate, from 1 to 1000 to 1 to 100, often serves to give relief.

Acute Glossitis.—Acute glossitis is quite rare. The tongue is enlarged, red, and exceedingly painful. Cleanliness and holding ice in the mouth usually suffices to produce relief in a very short time.

DISEASES OF THE SALIVARY GLANDS.

Acid secretion is really due to changes taking place within the mouth. It gives rise to a disagreeable taste, and often to disturbances of the digestion and injury to the teeth. It is readily recognized by testing the saliva with litmus paper. Brushing the teeth two or three times a day with bicarbonate of soda gives great relief and may ultimately cure the condition. Deficient secretion of the salivary glands is a condition that is very difficult to relieve. Mouth washes containing glycerin, small amounts of pilocarpine, $\frac{1}{2}$ gr. pill, allowed to dissolve slowly in the mouth, or galvanism locally to the gland, have at various times been employed, usually with but little success.

Calculi of the ducts of the salivary glands give rise to swelling of the gland and occasionally to fever during the passage of the calculus. If the calculus is not discharged, and the gland becomes infected, the case is surgical.

PAROTIDITIS.

Infectious Parotiditis.—Mumps is a disease of unknown etiology, but analogous to the acute infectious processes. It is apparently a general infection with its normal manifestations in the parotid and

sometimes in other glands. One attack confers immunity, but there is no specific treatment. As a rule the condition is mild, and rest in bed and light diet until recovery ensues are sufficient. After recovery the patient should be quarantined for at least ten days. If the attack is more severe certain other therapeutic measures may be required. These are, first, mouth washes. They should always be alkaline, and a simple mouth wash of borax appears to fulfil every needed indication. This may be used as often as desired, occasionally varying it to a weak solution of peroxide of hydrogen. Externally various applications may be made to the glands, but their variety is a sufficient proof of their usefulness. The ice-bag, cold compresses, hot compresses, hot-water bag, ichthyol, and a solution of magnesium sulphate have all been recommended; but I am rather inclined to think that none of them are of any actual benefit, although occasionally the warm applications appear to afford some relief from the pain. If the fever should become high, particularly if it is associated with delirium, various general measures are indicated. A tepid sponge often affords great relief, reducing the temperature and abating the delirium. Various drugs have also been given, particularly aconite, often combined with some diuretic, such as sweet spirits of nitre and potassium citrate, practically one of the old-fashioned fever mixtures. If the pulse is strong, phenacetin may also be used with advantage, from 1 to 5 grains, according to the age of the patient. The salicylates appear to be of no value, although a small dose of salol or aspirin may reduce the fever by causing sweating. Drugs that act directly upon the parotid gland, particularly pilocarpine, are of no benefit whatever. The diet should be light and no acids should be taken, as they apparently increase the pain. Rest in bed is desirable, for not only does it make the course of the disease milder, but it has the tendency to prevent the occurrence of complications. Complications are rare, but occasionally important. The most frequent is metastasis, if it may be so called, to the testicle in boys about the age of puberty. The testicle becomes swollen, tender, and there is usually local heat and increase in the general fever. The patient should rest in bed. The testicle should be elevated and some cooling application made, such as lead water and laudanum, or a piece of lint moistened with alcohol, or a saline solution. If metastasis of the breasts should occur in young women they should be treated in the same way by local applications designed to reduce the congestion, or locally by heat or cold, as in the case of the parotid gland. Metastasis of the pancreas is excessively rare. It is probable that the patient will do best on a diet similar to that given in diabetes, and it is possible that the administration of some pancreatic substance during the course of the complication might be of benefit.

Suppurative Parotiditis.—This is an infrequent but not excessively rare condition. It occurs after operations, in the course of typhoid fever, as a result of salivary calculi, and in persons whose mouths have been neglected, or who have some form of stomatitis. There is little medical treatment. Rest, scrupulous cleansing of the mouth, the use

of peroxide of hydrogen, cold applied externally, may in the milder cases render operation unnecessary. As soon as the swelling fluctuates it should be opened and drained.

PHARYNGITIS.

Acute pharyngitis corresponds to acute stomatitis, but is usually more severe. In the simple forms the administration of salicylates appears to be of great benefit. These may be combined with antiseptic washes, particularly solutions of potassium chlorate, sodium benzoate, or dilute solutions of the tincture of chloride of iron.

The chronic forms may be the expression of some local irritant, such as hypertrophy of the glandular follicles, or of some general intoxication. The local foci should be removed and the general intoxication combated.

In the specific infections, such as diphtheria and syphilis, specific treatment must be employed.

Phlegmonous pharyngitis requires surgical treatment.

DISEASES OF THE ESOPHAGUS.

The esophagus is a tube about sixteen inches long which has for its sole function the conveyance of the insalivated food from the pharynx into the stomach. It has no secretion excepting mucus, which serves as a lubricant, and its structure is not complicated. It is closed at each end by a sphincter, the upper being the muscles of the pharynx, the lower those of the cardia. At three points in its course, which are approximately five, ten, and fifteen inches from the teeth, it is partially compressed by surrounding structures. Practically the only functional disturbance is obstruction. This, however, may be brought about in a variety of ways. In addition, local irritation of the mucous membrane may be produced either by local irritants or in the course of acute infectious disease, particularly typhoid fever.

ESOPHAGITIS.

This is purely secondary to some violent irritation, such as caustic alkalies, strong acids, bichloride of mercury, or other substances swallowed either inadvertently or with suicidal intent. The esophageal symptoms are ordinarily dominated by those of the general poisoning. In the milder cases, where the irritation of the esophagus is the main condition, relief may be given by swallowing particles of ice or cold drinks. Oil emulsions and milk are also soothing. Relief of the pain for considerable length of time, an hour or more, may be obtained by giving the patient $\frac{1}{8}$ grain of beta-eucaine dissolved in a tablespoonful

of water. In more severe cases it may be necessary to employ morphine hypodermically.

Stricture of the Esophagus.—Stricture of the esophagus may be caused by the lodgement in it of a foreign body; by some disease of the wall, particularly carcinoma or tuberculosis; by pressure upon the esophagus of some organ or neoplasm, of which the commonest is aneurysm of the thoracic portion of the aorta; or by a malformation, such as a diverticulum. The treatment of a foreign body lodged in the esophagus varies with its nature.

If it is insufficiently chewed food, such as a piece of meat, it may be inducted into the stomach either by having the patient swallow some lubricating substance, olive oil or liquid vaseline, by relieving the spasm with hypodermics of atropine, possibly by gentle pressure with a bougie. The latter is such a dangerous procedure that it should never be undertaken excepting when the esophagoscope is in position, the object can be plainly seen, and the pushing is done by one skilled in the use of the instrument. In the great majority of cases it will be more satisfactory to employ the esophagoscope for the purpose of removing the object with suitable forceps.

ESOPHAGOSCOPY.

Various instruments have been devised, but it is only of late years that the technique has been so improved that the employment of the esophagoscope is not only satisfactory, but reasonably devoid of danger. All forms of flexible tubes have been abandoned, as have also methods of reflecting the light down the tube by means of a mirror. The first practical instrument was that of Einhorn, which consists simply of a tube from ten to sixteen inches long, into which fits an obturator, and in the side of which there is a small groove, along which a rod can be passed that bears on its end a minute electrical lamp. Jackson improved this instrument by the addition of a second tube, through which, by means of a suction apparatus, the secretions of the mouth, that are apt to run down the tube and obstruct the view, can be removed. The technique of the introduction of the instrument is as follows: The patient should be laid upon the table, which is so inclined that the hips are slightly higher than the shoulders. This prevents the accumulation of fluid in the esophagus from the mouth. Excepting in a few cases the patient should be etherized to the point of relaxation. The head is then bent backward and a special form of tongue depressor inserted which draws the root of the tongue well forward. The instrument, well lubricated, is inserted along the groove of this depressor, usually starting well to one side of the mouth. As soon as the tip reaches the pharynx the long axis of the instrument is made to coincide with the long axis of the body, and it is gradually introduced by a very gentle pushing movement with occasional slight twistings. As soon as the end of the esophagoscope meets with a distinct obstruction the obturator is withdrawn and the electricity turned on. There should be provided a number of gauze

sponges, fastened to the ends of long slender rods, with which the esophagus can be thoroughly swabbed. The picture that is seen is usually clear. Observation may be continued safely, providing the patient takes the ether well, as long as half an hour, and various operations undertaken, such as the removal of small fragments of a suspicious growth for microscopic examination, local applications to the ulcerated surfaces, or the extraction of a foreign body. It must be remembered that in extracting a foreign body its nature should be determined, and no pulling force should be employed if it involve any danger of penetrating the wall of the esophagus.

Cicatrizing strictures cause difficulty in swallowing, and although the esophagus is ordinarily without sensation the patient usually can locate with considerable accuracy the exact point of obstruction. The object of treatment is first to select food that is most easily swallowed, and second to dilate the stricture. As a rule, but not invariably, liquids are most easily taken. If solids are more easily taken it is usually an indication that there is considerable dilatation of the esophagus above the stricture. Oleaginous substances are the most satisfactory, and they may be given before other forms of food for the purpose of lubrication. Olive oil, in addition to its lubricating qualities, is a valuable nutriment; but ordinary vaseline in 15 grain doses gives excellent results, in my experience somewhat better than the olive oil. The only requisite regarding food is that it contain an adequate amount of nutriment, and if the swallowing is extremely difficult, concentrated foods should be employed, such as white of egg solutions, milk, olive oil, etc. I am in the habit of giving these patients a mixture consisting of eight ounces of milk, to which has been added a raw egg and half an ounce of milk sugar. This has a value in calories of between 450 and 500, and if given three times a day, perhaps in divided doses, will suffice to maintain life. If there is much esophageal irritation it is also of advantage to give $\frac{1}{8}$ grain of beta-eucaine dissolved in water just before the patient attempts to swallow food. This, however, is chiefly useful in malignant organic strictures.

Dilatation of the stricture is properly one of the operations that belongs to the internal clinician. Two kinds of bougies are employed, the olive tip and the so-called English or conical tip bougie.

The technique of the dilatation of the stricture is as follows: The patient sits in a chair facing the physician. The back of the chair should be sufficiently high to enable the patient to rest his head comfortably against it. With the head in the ordinary position the bougie is introduced until it touches the posterior wall of the pharynx. The patient then brings the head at an angle of 45 degrees backward, the bougie is carried toward the back of the mouth, and the tip gently directed down the pharynx toward the esophagus. The patient is then instructed to swallow, or if this is difficult, to cough. At the same time a gentle push is given, and ordinarily the bougie slips beyond the thyroid cartilage, which chiefly obstructs its advance into the esophagus. It can now be pushed fairly rapidly until it reaches the stricture. At this point a rotary movement is employed, and the bougie gently pushed through the

stricture, which it passes, with a distinct sense of resistance. The length of the stricture can often be determined by the duration of this resistance. If the olive-tip bougie is employed it is then gently withdrawn through the stricture, dilating it on its return. If the conical-tipped bougie is employed it is allowed to remain in position for three or four minutes until any spasmodic contraction at the site of the stricture has relaxed.

If the patient seems exhausted or much pain has been produced, further attempts at dilatation should not be made, but ordinarily it is possible immediately to use the next larger size and even one or two more. Of course, if the bougie cannot be made to penetrate the stricture in the first instance a smaller size should be attempted. Ordinarily it is safe to begin with a medium-sized bougie, about 5 to 10 mm. in diameter. There is little danger of a bougie of this size penetrating or causing hemorrhages. Accurate information is obtained regarding the distance of the stricture from the teeth by marking the stem and measuring afterward from the marking to the tip. As a general rule, dilatation should be practised about every second day until a bougie of adequate size can be introduced. Repetition of the operation may be necessary every two or three months. Stricture of the esophagus due to malignant disease is necessarily a fatal condition. The main object of treatment is to produce as much relief as possible. In the early stages, dilatation may give relief for a considerable period of time, often several weeks. As the tumor continues to grow the instrument is to be used more frequently, and the size that can be employed steadily diminishes. In the course of a few months only a very small amount of food can be taken, and of this probably little enters the stomach. In the meantime a certain amount of relief may be produced by the measures already advocated. Sooner or later the question of gastrostomy must be considered. At best it serves only to prolong life a few weeks. The patient rapidly sinks into a state of profound cachexia, and dies in spite of any form of treatment. Aside from gastrostomy, surgical treatment at the present time is not justified, for the results of attempts to remove the esophageal carcinoma have been invariably fatal.

TUBERCULOSIS OF THE ESOPHAGUS.

Tuberculosis of the esophagus is probably more common than has been believed, because the clinical course is almost identical with that of carcinoma. The early symptoms are the same, but in the two cases that I have seen the obstruction was situated about ten inches from the teeth, somewhat higher than the most frequent seat of carcinoma. There is this difference in the course, that a gastrostomy will serve indefinitely to prolong life. In the two cases to which I allude the diagnosis of the first was made at autopsy, and the second by the microscopic examination of a fragment of the wall of the esophagus removed through the esophagoscope and subsequently by finding tubercle bacilli in the secretion removed from the esophagus just above the stricture. This patient has

lived for a year fed entirely through the gastrostomy opening; the feeding has consisted of peptonized milk, twelve ounces, six times a day. To each feeding is added a raw egg and half an ounce of sugar of milk, so that the caloric value (2400) is satisfactory. Nevertheless, she has not gained in weight. In addition this patient for six months has received therapeutic doses of tuberculin, with the idea of promoting the healing of the tuberculous process, but no results whatever have been observed.

DIVERTICULUM OF THE ESOPHAGUS.

Diverticulum of the esophagus is apparently a rare condition. The symptoms are those of partial stricture, and increase very slowly in severity. The treatment is unsatisfactory. Relief may be given first by lavage of the esophagus. For this purpose the ordinary stomach tube, usually of small caliber, about 24 French, is employed; a mark is made upon it fourteen inches from the end, and it is then inserted until the mark is at the level of the teeth. This, of course, applies to a diverticulum in the lower portion of the esophagus. Water is then poured in, starting with one ounce, which is siphoned off, and if this causes no discomfort, larger quantities can be used, depending, of course, upon the size of the diverticulum and the degree of dilatation of the esophagus above it. This washing should be performed daily. In addition sounds may be passed, very little force being employed, for fear that they may enter the diverticulum and perforate it. If it is possible to pass the sound into the stomach, considerable relief is afforded and the patient can usually swallow pretty freely for several days. As in carcinoma, tuberculosis, or organic stricture, ultimately the question of gastrostomy will arise; but in this condition, as in cicatricial stricture, there should be no delay in its performance, for not only is there little danger of death being caused by the diverticulum, unless it is perforated, but the stomach contents are fairly normal and nutrition is maintained.

SPASM OF THE CARDIA.

Spasm of the cardia is not excessively rare. Apparently it causes a feeling as if a lump were present back of the lower part of the sternum. It may cause dysphagia, and if it occur frequently enough it may interfere with nutrition. It may be regarded as a neurosis, and can be relieved by general treatment of the nervous condition, bromides being particularly valuable. They should be given in full doses. The passage of the bougie will often relieve the condition permanently; but if it does not succeed at first, it soon loses its effect. Lavage of the stomach, or if this is impossible, of the esophagus, with warm water (about 115°) also may produce a permanent cure.

DISEASES OF THE STOMACH.

MALPOSITION OF THE STOMACH.

Gastroptosis is a condition in which the greater curvature of the stomach is lower than the level of the umbilicus. This may be regarded as the simplest possible definition. It may be congenital and associated with ptosis of the other organs or acquired chiefly as a result of some condition that causes relaxation of the abdominal walls, and may involve also ptosis of the other organs. In itself it is not a disease, and does not require treatment. Very frequently, however, the malposition of the stomach produces in various ways a tendency to obstruction. As a result of this the stomach may be dilated and alterations may take place in the secretions. The treatment is difficult, and in the majority of cases unsatisfactory. It involves (1) the restoration, if possible, of the stomach to its normal position, or at least to a position that will prevent the formation of an obstruction; (2) the improvement of the tone of the abdominal muscles, so that they will adequately support the abdominal viscera; (3) the restoration of the nutrition of the patient. The methods employed to restore the stomach to its position may be classified roughly as posture, abdominal supporters, and operative interference. The postural treatment consists of having the patient lie with the hips higher than the shoulders. This attitude cannot be maintained indefinitely, but it may be employed for from half to three-quarters of an hour after each meal, so that the weight of the chyme does not drag the stomach downward and accentuate the condition. This seems also to promote the evacuation of the stomach contents into the intestines, and the nutrition of the patient may, as a result, improve, although nothing else is done. It may be accomplished by having the patient lie flat upon the back on a fairly stiff couch, with one or two pillows under the hips, or he may lie upon a cot, the foot of which is about six inches higher than the head.

The exact nature of the exercises employed is not of great importance, providing they serve to strengthen the abdominal muscles. I may, however, mention three movements that are of considerable advantage:

1. Patient lies flat on the floor, keeping the legs straight, raises them slowly to a perpendicular position, then slowly lets them fall.
2. Patient lies flat on the floor and rises slowly to a sitting posture, and slowly sinks back again without lifting the heels from the floor.
3. Patient lies with the buttocks on a chair, the feet caught under some other article of furniture. He then bends as far back as possible and rises suddenly to a sitting posture, with a spring-like action. All forms of general exercise have a tendency to strengthen the abdominal muscles.

Abdominal supports may be classified in three groups: adhesive straps, abdominal binders, and the straight front corset.

Adhesive straps furnish ideal support, but have the disadvantage, sooner or later, of irritating the skin. Moreover, the plaster in the course

of a few days becomes loose and ceases to give support. Rose has had the plaster material spread upon goldbeater's skin instead of muslin, and considers that there is less irritation, but the advantage, if any, is very slight.

The methods of application of the plaster are numerous and complicated, but I have reached the conclusion that a simple spica is the best. It should be made of strips of plaster about two inches wide and of sufficient length to go half-way around the body and lap at the back and front. Usually eight straps are sufficient. The plaster should be put on with the patient standing up, not lying down. The first strap is placed just above the symphysis pubes, overlapping the median line about two inches. It is then carried obliquely upward and backward, the lower edge above the crest of the ilium, until it passes the spinal column in the back. It must be applied smoothly. A second piece is then placed in a corresponding position on the opposite side. Both pieces are then partly detached and pulled firmly until the lower part of the abdomen is noticeably lifted. They are then applied smoothly to the back, crossing each other. The second pair of straps is applied, overlapping the first about one inch, and this is continued until there is a distinct bulging of the upper half of the abdomen. Ordinarily, if the application is made with sufficient force, the patient feels relief at once.

FIG. 28



Another method that has served well, but I think is not quite as satisfactory as the one described, is as follows:

A strip of plaster seven inches wide and about six inches longer than the circumference of the abdomen is employed. Beginning about two inches from either end, this is cut in two pieces by a curved line, which extends to within one inch of the opposite side, the direction of which is shown in the diagram. The upper portion is placed over the abdomen, with the edge of the curve touching the symphysis, and is pulled as tightly as possible around the back. The concave portion is then cut in half at its narrowest part, and is so applied that the two right angles are downward in front, while the narrow ends are pulled as tightly as possible and crossed over the back.

As a rule, the plaster can be worn without discomfort for five or six days,

and I had one patient who wore such a plaster binder for six weeks without distress. Plaster should always be removed with ether, and preferably first moistened with some oil, such as the oil of wintergreen.

There have been devised a great number of *abdominal binders*, many of which are unsatisfactory. The ideal binder, it seems to me, should fulfil the following requirements: It must be straight in front, not curved to conform to the abdomen. It should lack elasticity. The binder that is capable of yielding may permit the viscera to slip downward and then by contraction of its upper edge hold them in that position and make matters worse than they were before. The binder itself should provide the support; thus, straps and other methods of reinforcing the binder render it little better than a scaffold to which they may be attached. It should be light. The binder that is heavy is uncomfortable at any time, and becomes unbearable in hot weather. I am inclined to believe that the best binder hitherto devised is the original form of Glénard's. This consists of a strip of linen or other non-elastic material, from six to eight inches wide, which passes around the body and is fastened in the back or front by four or five straps and buckles. Two straps or rubber tubes pass under the thighs in order to keep it from slipping up. I have used this binder in many cases with entire success, but sometimes it has a tendency to wrinkle, and very often, as the lower edge must pass below the crest of the ilium, it interferes with walking and sitting down. The wrinkling can be prevented by the insertion of whalebone. The latter objection can be largely obviated by modifying the shape of the binder so that it fits the body obliquely, being higher in the back than in the front. As a rule, a good seamstress makes a more satisfactory binder of this type than an instrument maker. An advantage of this binder is its cheapness, the materials of one made by one of my patients costing altogether only 27 cents. The test of all binders is the same as that of adhesive straps. The circumference of the abdomen above the umbilicus should be increased after they have been put on. In very thin persons it may be necessary to reinforce the pressure of the binder over the lower portion of the abdomen with a pad. This is best made of muslin stuffed with hair and covered with silk.

The *surgical methods of treating gastroptosis* are not particularly efficient. Entirely useless are all forms of resection of the abdominal wall, all operations which aim to shorten the stomach either by taking a tuck in the wall or actually removing a segment. Three general plans have been tried, and in certain cases found effectual: (1) The method of Beye, aims to elevate the stomach by shortening the gastrohepatic omentum. This is often of great service, not, I believe, because it actually elevates the stomach, but because it straightens the lesser curvature and prevents a kink. (2) The operation of Coffey consists in attaching the transverse colon by its mesocolon to the anterior abdominal wall. This relieves the stomach entirely of the strain of supporting the colon and probably permits it, to a certain extent, to regain its normal position. These two operations are often combined. (3) Gastro-enterostomy provides a by-pass for any contents that may be hindered from passing

PLATE XI



Profile View of Abdomen after Binder has been Applied.

Lower portion of abdomen has been lifted distinctly, so that the chief prominence is just below the umbilicus, and the whole upper portion of the abdomen has been thrust forward, as the result of the crowding up of the abdominal viscera.

PLATE XII



Same Case after Binder has been Applied.

The umbilicus is now above the levels of the crests of the ilia, and as a result of the crowding up of the abdominal viscera, points downward. Position of the patient is more erect, and the whole attitude suggests support and relief.

into the intestines by the normal route. Rarely it is brilliantly successful.

The improvement of nutrition is the most essential feature of the treatment. Glénard in one of his early papers spoke of the value of the Weir Mitchell rest cure, and it still remains the best method at our command. The patient should be put to bed under the care of a competent nurse. Food should be given at frequent intervals in moderate quantities. Massage and electricity should be employed to stimulate the muscles and prevent the patient from suffering from lack of exercise. The treatment should be continued until a distinct gain in weight, at least ten pounds, has been achieved. In the majority of cases there will be no gain for the first two weeks, and there may even be a loss. After this the patient begins to gain often rapidly from a quarter to one pound a day, and this gain is usually steady. The cure is best undertaken away from the patient's home, and I have had my best success in the private rooms of general hospitals. The advantage of a large institution is the routine manner in which the work is performed and the inability of the patient to insist upon attendance to every minor ailment. The amount of food given in a day should be equivalent to between three and four thousand calories, and a more or less typical schedule is as follows:

8 A.M. Fruit, cereal, with 4 ounces of cream, two eggs, toast, and 8 ounces of cocoa made with milk.

9 A.M. A cleansing bath.

10 A.M. Eight ounces of milk, with crackers, zwieback, or pulled bread.

11 A.M. Electricity. I prefer the slowly interrupted faradic current. Each muscle or group of muscles should be given four or five contractions, and the whole body covered. This will take at least one hour.

12 until 1. Patient should rest quietly.

1 P.M. Soup, meat, two vegetables, and either salad or light dessert.

3.30 P.M. Eight ounces of milk and some light cakes.

4 P.M. Light general massage.

5 P.M. Undisturbed rest.

6.30 P.M. Milk toast, omelet or oyster stew, chocolate or cocoa, and some stewed fruit.

9 P.M. Glass of milk and some toast, followed by an alcohol rub, and the patient prepared for sleep at 9.30 P.M.

In one case of profound malnutrition, in addition to this, I had the patient awakened at 3 A.M. for a cup of hot chocolate and toast, or some similar light luncheon. She soon grew accustomed to the disturbance, and did not remain awake longer than it was necessary to partake of the food.

If the nutrition is only slightly disturbed, it may suffice to have the patient take a light luncheon between each meal and before bedtime, and to rest half an hour after each regular meal and after each luncheon, getting exercise by walking in the open air.

Sleeping in the open air also serves as a powerful stimulant to nutrition, and these cases are no exception to the general rule.

Change of climate is also often beneficial; more so, it seems to me,

because it is a change than on account of any specific effect that any particular type of climate exerts upon this condition. I have also had excellent results with patients who went into the woods to camp. The novelty of the life out-of-doors and the keen appetite that usually belongs to the camper have, I believe, combined to produce distinct improvement.

Treatment of the complications and associated conditions requires very little modification on account of the gastropstosis.

Hyperchlorhydria is the commonest complication. It is the type associated with retention, and requires a moderate degree of neutralization and other measures that will be discussed later. Attacks of vomiting are not uncommon, in some cases they occur daily. If the attacks are paroxysmal and occur after a period of apparent comfort they are best relieved by placing the patient in bed for a rather prolonged period, at first restricting the food to very small quantities, given at frequent intervals, then gradually increasing the quantity as the tolerance of the stomach is established, until the patient is able to take again a normal amount of food. The duration of the attack can often be shortened by recourse to lavage; one or two washings of the stomach, especially in the morning before breakfast, so that it is thoroughly cleansed and retracted before food is taken, relieves the nausea sometimes for a day, sometimes almost completely. A well-fitting binder, particularly of adhesive plaster, will also sometimes cut short the attacks.

Acquired gastropstosis, following pregnancy, emaciation, and ascites, is usually a milder matter than the congenital form, if the morbid condition that is giving rise to it can be relieved. A well-fitting binder that actually gives support will often afford entire relief. If emaciation is not produced by some chronic wasting disease the restoration of the normal degree of nutrition is sufficient to cure the condition.

EVENTRATION OF THE DIAPHRAGM.

This is a condition which is characterized by hypoplasia of the left lung, arching upward of the left side of the diaphragm and the consequent dislocation upward of the stomach and spleen. The signs in some respects resemble those of left-sided pneumothorax. This condition is a congenital malformation that cannot be corrected by surgical measures. Its recognition is only important for the purpose of preventing surgical interference upon the bases of mistaken diagnosis.

DISPLACEMENTS OF THE STOMACH.

Displacements of the stomach are comparatively rare. They occur, however, quite constantly in most cases of distortion of the spinal column. I have seen one case of pronounced scoliosis in which the x-ray revealed the stomach in the right lower quadrant of the abdomen. This patient had signs of partial obstruction and retention. The treatment is, of

course, most unsatisfactory. Practically nothing can be done to replace the stomach, even a surgical operation offering little likelihood of relief. Careful regulation of the diet, restoring to a normal condition the gastric secretions, if this is possible, the use of oil for lubrication may all be employed, and occasionally some relief is afforded, if the patient is still young enough, by measures to correct the spinal deformity. In the severer forms of these cases, persistent lavage is necessary, the stomach being washed out every morning, and sometimes in the evening, to remove the accumulation, so that for a time at least it is clean and the secretions will have an opportunity of acting upon food not bathed in mucus. In one case of this nature that I saw, a gastro-enterostomy gave no relief.

ALTERATION IN THE SIZE OF THE STOMACH.

Dilatation of the Stomach.—By *dilatation of the stomach* we mean that the organ for some reason has become more capacious than it should be under normal circumstances.

Chronic dilatation may not be associated with any functional disturbance, but in the great majority of cases it is associated with a weakness of the wall or with an obstructive lesion at the pylorus, and it is to these forms that the term *gastrectasia* is usually restricted. If the enlargement is due simply to a muscular insufficiency and a thinning and dilatation of the wall of the stomach, we speak of *atonic gastrectasia*. There is, to my mind, considerable doubt whether this form actually exists. If it is due to some obstruction at the outlet of the stomach we speak of *stenotic gastrectasia* with retention.

Acute dilatation of the stomach is usually secondary to a severe injury, prolonged anesthesia, a severe illness, or a prolonged debauch. The symptoms are prostration, repugnance to food, some nausea, rarely much vomiting, and the signs of a thready pulse, a leaky skin, ordinarily a subnormal temperature, and a huge gastric tumor.

The treatment consists first in the evacuation of the stomach. The amount that is recovered in these cases, particularly in acute dilatation following a debauch, perhaps the commonest form, is enormous. In one of my cases over a gallon was removed upon the first introduction of the tube. The stomach is then gently washed with water at about 105° F. This acts as a mild relaxant to both sphincters, which until the lavage are usually closed tightly. In addition the patient is stimulated by hypodermics of strychnine, hypodermoclysis, or the introduction into the veins of a pint of physiological salt solution. There must be absolute rest in bed, and if there is great restlessness morphine hypodermically is indicated. If food seems for any reason to be necessary a nutrient enema should be given. The lavage may be repeated in one or two hours if the gastric tumor has not subsided. As a rule, the course of the case is determined in three or four hours, and sometimes after the first lavage the tumor subsides, the patient becomes quiet, and the case proceeds uninterruptedly to recovery. If everything is favorable at the

end of twenty-four hours the patient can begin to take small quantities of water by the mouth, followed by beef tea, pressed beef juice, whey, and finally milk. If there is any tendency to nausea or vomiting or any reappearance of the gastric tumor, food by the mouth must be immediately suspended and lavage performed. If there is any indication of mechanical obstruction of the pylorus, an immediate operation is indicated, otherwise it seems to me that there is no advantage in an operation, and it increases the gravity of the prognosis. If possible a repetition of the causative factor should be avoided.

The object of any treatment in *chronic gastrectasia* is to promote as much as possible the evacuation of the stomach contents into the intestines and to maintain the nutrition of the patient. This is in part prevented by spasm of the pylorus, or by organic stricture of it.

Spasm of the Pylorus.—Spasm of the pylorus is in part maintained by the acidity of the gastric juice. It therefore behooves us first to restore the stomach contents as nearly as possible to their natural condition. If, as is usually the case, they are acid, we have various drugs at our disposal. Bicarbonate of soda is not a powerful alkali, and in the presence of an acid it liberates a considerable amount of carbonic acid gas, which may serve to distend the stomach and add to its inability to discharge its contents. Magnesium oxide is about five times as efficient, weight for weight, in neutralizing the acidity. It does not liberate gas and acts mildly as a laxative. Atropine acts in two ways. It inhibits to a slight degree the secretion of the gastric juices, and if the dose is sufficiently large it tends to relax the spasm of the muscular tissue. Oil apparently serves as a lubricant, permitting the egress of the gastric contents to take place more readily. Possibly it also serves as a protector to the mucous membrane, and prevents, to a certain degree, the irritation by the acid that serves to promote the contraction. Olive oil may be given in doses from 1 dram to 1 ounce, three or four times a day, depending upon the toleration of the patient, and may serve to keep the patient in good condition for very long periods of time. I have also had good results with petrolatum, administered in cachets. It does not decompose into glycerin and the fatty acids as does olive oil, and once in contact with mucous membrane, probably protects it for a long time. Bismuth also serves as a protective, and is particularly useful in those forms of spasm associated with ulceration of the mucous membrane near the pylorus. The method of administration will be described in the section on gastric ulcer.

Retention of the chyme is very apt to cause catarrh. The mucous secretion then becomes impregnated with acid, and maintains a continual irritation of the mucous membrane. It is therefore desirable to keep the stomach thoroughly clean, and it is particularly in those cases that lavage is of use as a therapeutic measure. It should be done either before breakfast or before the evening meal, and should be continued until the water returns perfectly clear. As a rule, after two or three days it can be suspended with advantage, and recommenced only when symptoms indicate it.

Technique of Lavage of the Stomach.—This may vary a good deal in accordance with the experience of the patient and the physician. The following method is adequate in practically all cases excepting those in which force must be used. The patient sits in a chair. A towel is pinned around the neck and a rubber apron covers the front of the body. On the floor is a rubber cloth, and upon this just in front of the patient's feet a china bucket is placed. The patient is given a towel to hold in the hand. The tube, which has been thoroughly cleansed and then boiled, is dipped into cold water or thoroughly cooled in crushed ice. No lubricant is necessary. The physician stands by the patient's side holding the tube in the right hand if upon the right side, and in the left hand if on the left side. The tip is inserted between the teeth and pushed gently back until it reaches the wall of the pharynx; the patient is then instructed to make a swallowing movement and at the same time a little force is used and the tip of the tube engages the pharynx. The patient should then be permitted to rest for a few seconds and the tube gently pushed down the esophagus, along which it glides without difficulty, the progress being stopped whenever the patient seems to desire it. If there is much choking sensation, the patient should be instructed to take several deep breaths, while the tube is held stationary. As soon as it reaches the mark, 19 inches from the tip of the tube, it is stopped and the patient instructed to wrap the towel around it and to hold it close to the mouth, not permitting it to slip out. The open end of the tube usually contains a funnel which ordinarily is permitted to rest in the bucket and is elevated until the insertion is finished. It is then brought to the level of the patient's mouth and lavage is commenced. The water should be warmed to 100° F. This is best accomplished by having two pitchers, one with hot and the other with cold water, a graduate in which they can be mixed, and a thermometer for testing the resulting temperature. The graduate should hold about a pint, and this is ordinarily enough to introduce into the stomach at one time. The water is poured in slowly until the entire quantity has been taken. The funnel is then depressed until it fills, raised, and again depressed, and finally the stomach contents are allowed to flow into the bucket. If there is much admixture of chyme or mucus the washing is repeated as often as may be necessary, care being taken that the patient is not exhausted. When the washing is complete the towel is grasped in one hand and the funnel in the other, the tube being drawn out, allowing it to glide through the towel until its tip reaches the teeth. It is then grasped and thrown into some receptacle for cleansing.

Certain difficulties may arise in the course of this operation. Patients taking the tube for the first time will have a tendency to grasp it and withdraw it or to bite it so firmly that it cannot be inserted farther. This can only be overcome by urging the patient to aid the physician in every way. The passage of the tube may cause vomiting. If this is very violent the tube will also be vomited, but if it is slight, merely regurgitation around the tube; as a rule, as soon as the tube is inserted into the stomach the chyme will flow through it and the vomiting will stop. If the vomiting

occurs during the course of lavage, it is probable that the end of the tube has been obstructed, and sometimes blowing a little air into the tube will relieve the obstruction and enable the washing to proceed satisfactorily. Occasionally the tube in the throat may cause coughing. This can sometimes be relieved by first painting the throat with a weak solution of eucaïne or cocaine, but ordinarily it is better to abandon the attempt to wash the stomach. Occasionally there is difficulty on passing the tube. Twice it has occurred to me that the tube has slipped into the trachea, on one patient three times in succession. Respiration was accomplished apparently with little difficulty through the tube, and there was no cyanosis and only a slight cough. Indeed, in the first case practically no discomfort was produced. Of course, as soon as it is realized that the tube has left the esophagus it should be immediately withdrawn. The slight symptoms in the two cases I cited were probably due to a certain degree of anesthesia of the glottis. Otherwise the tube could not have passed as it did. Cases are on record in which tubes without funnel and bulb have been swallowed, requiring a subsequent gastrostomy. There is, however, slight danger of this. Occasionally the lavage will produce hemorrhage, and it is questionable under these circumstances with the tube in position whether it is not better to pour into the stomach some styptic mixture, such as the tincture of chloride of iron well diluted, rather than to withdraw the tube immediately and allow the hemorrhage to go on uncontrolled. It is also possible that flushing the stomach with water at a temperature of 110° to 120° F. may be of advantage, although in the two cases in which hemorrhage occurred in my experience during lavage water of this temperature was not available. Other measures for controlling hemorrhages should also be employed. The number of remedies which have been introduced into the stomach through the stomach tube is considerable. Among the most important are solutions of bicarbonate of soda, about 5 per cent.; salicylate of soda, about 1 per cent.; nitrate of silver, from 1 to 10,000 to 1 to 1000; various organic preparations of silver, of no great use, in solution from 0.1 per cent. to 1 per cent; suspensions of bismuth for protecting purposes; and pure olive oil.

The diet should be as non-irritating as possible. For this reason highly spiced food and all acid foods should be avoided, and it is probable that certain meats, particularly high game and red meats, should either be avoided or limited in amount. Foods that are apt to remain bulky in the stomach, particularly vegetables, with an abundance of coarse fiber, or those with indigestible leaves, such as lettuce, must be taken sparingly. It is undesirable to overload the stomach at any time, because, if there is retention, the sagging down due to the weight of the chyme may exaggerate it. It is therefore desirable for the patient to eat frequently and to consume smaller quantities of food.

Depending upon the degree of obstruction will be the necessity for surgical interference. In organic stenosis it is nearly always necessary. In functional stenosis, that is in cases of pyloric spasm, it is rarely indicated. Positive indication for interference may be considered visible

peristalsis, loss of weight, and persistent vomiting or regurgitation of food. The nature of the operation need not here be discussed, excepting to state that in my experience a gastro-enterostomy for a partial stenosis of the pylorus without closure of the pylorus rarely is permanently successful, and I am inclined to believe that in these cases some plastic operation upon the pylorus, providing, of course, there is no malignancy, may in the end be recognized as the preferable method.

CONTRACTION OF THE STOMACH.

Gastric Contraction.—Gastric contraction, or gastric linitis, is a very rare condition, diagnosticated, as a rule, only at autopsy or operation, although it would seem the diagnosis should be made during life. There is no definite symptomatology, and, so far as known, no treatment, not even operative.

Localized Contraction.—Localized contraction of the stomach is due, as a rule, to extensive cicatricial contraction following ulceration. The medical treatment does not differ essentially from that of stenosis of the pylorus. Sooner or later an operation must be performed, and, as a rule, it is desirable that it should be performed as soon as the diagnosis has been made.

Diverticula.—Diverticula of the stomach are exceedingly rare. It is possible that they may be recognized more readily by the employment of the x -rays. Should the diverticulum become inflamed it would give symptoms resembling those of a localized abscess. The only treatment is operative.

DISTURBANCE OF MOTILITY.

By motility is meant the rapidity or slowness with which the stomach evacuates its contents into the intestines. It may be said, as a general rule, that the stomach should be empty in the morning before breakfast, and after the test breakfast of bread and water nothing should be found in the stomach two hours later. But after a proteid test meal, such as that of Fisher, the stomach should be practically empty at the end of four hours, although a slight discoloration of the wash water will not necessarily indicate any actual disturbance of motility. On the other hand, if, after a test breakfast, the stomach is empty at the expiration of three hours, it is hardly justifiable to conclude that hypermotility exists. Even indigestible particles of food, such as the skins of prunes, should disappear in a period from eight to twelve hours, such as commonly elapses between supper and breakfast. The presence of distinct splashing three hours after taking food may also be regarded as fairly good evidence that the stomach has not completed its work promptly. Much more accurate determination of the motility of the stomach can, however, be made by means of the x -rays and the fluoroscope.

Hypermotility.—By hypermotility we mean those conditions in which the stomach empties itself too early. I have been accustomed to assume the existence of this condition if half an hour after the administration of the toast and water breakfast a thorough washing shows that the stomach is practically empty, and if one hour after the Fisher test meal a thorough washing produces mere traces of the meat and a slight discoloration of the water. Hypermotility is relatively common. It is supposed to occur in certain cases of scirrhus cancer that lead to channelling of the pylorus. It also occurs sometimes in cases of hyperacidity without obstruction, and is probably due to the failure of the acid chyme to stimulate the duodenum. I have observed it in two cases associated with hyperchlorhydria. Curiously enough it is exceedingly rare after gastro-enterostomy, and personally I have not observed a single case. The treatment, of course, varies considerably with the nature of the condition. In a case of *scirrhus carcinoma*, if it be inoperable, practically nothing can be done, although large doses of bismuth, perhaps, reinforced with small doses of opium, morphine, or codeine, may serve to render the patient more comfortable. In cases of subacidity the correction of the secretory defect, if it can be achieved, will relieve the insufficiency of the pylorus. In cases associated with hyperchlorhydria the mechanism appears to be exceedingly obscure. Both cases that I saw were habitual tube users, washing out the stomach nearly always three times a day, that is, practically after each meal. The washing was usually done a couple of hours after the meal had been taken. Whether there was some compensatory mechanism on the part of the stomach or whether the hypermotility had existed before this excessive lavage is, of course, impossible to say. Both patients were quite promptly relieved by putting them on the alkaline treatment for hyperchlorhydria, and in addition giving them $\frac{1}{16}$ grain of morphine after each meal. This was discontinued at the end of a few weeks, with persistent relief of the symptoms.

Submotility.—Submotility is commonly associated with either stenotic or atonic gastrectasia. In rare cases it appears to occur almost as a lesion by itself, and in the atonic forms of gastric dilatation, if they exist, there is apparently no mechanical hindrances to the expulsion of the gastric contents. Treatment in these cases cannot be said to be satisfactory. A considerable number of remedies have, however, from time to time, been suggested. Of the drugs, the most popular are strychnine and the bitter stomachics, and it is possible that a belief on the part of the general practitioner that cases of submotility are common is responsible for the extraordinary vogue of certain mixtures such as *nux vomica* and *gentian*. The employment of the tincture of *nux vomica* alone in ascending doses has also been recommended by high authority, but the indications are not explicitly defined, and apparently it is to be used more or less indiscriminately. In difficult cases, especially if associated with emaciation, my personal experience has been distinctly unfavorable. Strychnine, either by the mouth or hypodermically, in fairly large doses, may possibly be of value in these conditions. Of the so-called bitter stomachics, the most

that can be expected of them is a slight stimulation of the appetite and a consequent improvement in the nutrition. The object of treatment, of course, is to restore the tone of the gastric musculature. For this purpose it has seemed to me that our best hope lay in the development of the muscles as a whole. If the patient suffers from malnutrition, rest cure and passive exercise, followed by gradually increasing active exercises until not only has weight been gained but the muscles have become hard, is nearly always followed or associated with a distinct improvement in the motility of the stomach. If the nutrition is fairly good, then active exercise may be commenced at once. This should be associated with life in the open air as much as possible, and freedom from mental worry, if this desirable condition can ever be achieved. At the same time the gastric secretions should be corrected as much as possible, food given in small quantities at short intervals, and water taken freely, for it stimulates the motility of the stomach. The variety of mechanical measures that have been devised is considerable. Various experts in massage claim to be able to stimulate the stomach by the peculiarity of their manipulations. Other physicians stimulate the wall of the stomach by various sprays, by alternate hot and cold douches to the wall, by intragastric galvanism, by the static coil, and by various applications and procedures to the spinal column. Of many of these methods I am not qualified to give an opinion, not having personally employed them; but I have seen many patients upon whom they have been employed without benefit, and their use is so limited among the profession that I am inclined to think that other physicians share my distrust.

DISTURBANCES OF SECRETION.

Hyperchlorhydria.—Hyperchlorhydria is rather a chemical sign than a clinical entity. Its exact limits are difficult to define. It is produced, apparently, by a variety of conditions, and the amount of functional disturbance appears to bear no exact proportion to the excess of acid in the stomach contents. There is considerable dispute regarding the amount of acid that should be found normally in the stomach contents one hour after the ingestion of a test breakfast. The estimation varies all the way from thirty to sixty, according to the Ewald scale, that is, from about 0.1 to 0.2 per cent of pure hydrochloric acid. My own personal experience leads me to believe that in the normal stomach the acidity may vary between thirty and fifty, and it may even reach sixty without producing symptoms; but in many cases, if the acidity is between fifty and sixty, distinct symptoms may be present. After a meat test meal, such as that of Fisher, the total acidity at the end of three hours should be considerably higher, ranging from 110 to 140 in normal cases—that is, from about 0.4 to 0.5 per cent. of pure hydrochloric acid. The amount of free acid appears to depend so much upon the proteid that is ingested that its actual estimation is of comparatively little importance. The question is greatly complicated by the fact that under some circumstances the same stomach

may secrete too much acid and under others too little. This is particularly true of the type that I have preferred to call the irritable secretion, in which the total acidity after the bread and water test meal is practically the same as the total acidity after the bread, meat, and water test meal—that is to say, the stomach always secretes to its maximum capacity. In these cases there is a hyperchlorhydria after a light meal and a sub-acidity after a heavy meal, and the treatment of the two conditions, of course, must vary accordingly. Further complications arise from the fact that excess of acid may be brought about in two ways: (1) By the secretion of a gastric juice too rich in hydrochloric acid, and (2) by the secretion of an excessive amount of gastric juice containing the normal proportion of acid.

It is probable that variations in the secretions of the gastric juice constantly occur, and up to the present they have almost completely eluded our methods of investigation. It is true that Matthieu, Sahli, and Meunier have devised methods by which theoretically it is possible to estimate accurately the proportion of gastric juice in a given time and to reckon from this the exact acidity of the gastric juice. Unfortunately these methods are exceedingly difficult to apply with any degree of accuracy, and they all depend upon the method of Matthieu and Remond for estimating the total content of the stomach at the time of the removal of the test meal, and this method, as I have shown, is exceedingly inaccurate.

The treatment may be directed to a variety of indications: (1) To control the excessive secretion of the gastric juice if this exists, (2) to neutralize the excessive acidity; (3) to promote the evacuation of the stomach contents; (4) to relieve the pain or the discomfort. In mild cases of hyperchlorhydria much can be accomplished by the diet. A variety of diets have been devised, and probably all of them are valuable in certain cases. Acid foods should usually be avoided. Among these are fresh fruits, tomatoes, rhubarb, and all salads. It has been generally assumed, without adequate experimental basis, however, that the heavier meats are also undesirable, particularly beef, mutton, pork, and game, and also certain organs, such as liver, sweetbreads, and kidneys, on account of their excess of the meat extractives, which, as a rule, stimulate the secretion of the gastric juice. Foods digested with difficulty, particularly pastries and highly seasoned dishes, are also, as a rule, omitted. Excessive indulgence in sweet foods appears to be undesirable, largely, perhaps, because the yeasts which are usually abundant in the stomach contents ferment the sugars. Alcohol, particularly in the form of acid wines or in the form of heavier drinks, such as whisky, brandy, sherry, port, must be forbidden, and as these patients usually have an excess of gas, all carbonated waters are to be used very sparingly. These include the sparkling wines, champagne, beer, and the gaseous soft drinks and mineral waters. Tea and coffee are distinctly injurious. There are certain exceptions to these rules. Ham and bacon may be permitted in moderation. Beef may also be allowed occasionally, although daily indulgence does not seem to be desirable. In many cases fresh fruits taken upon an

empty stomach, or before breakfast, do not appear to increase the symptoms or, apparently, the total acidity.

As many of these patients suffer pain particularly when the stomach is empty or nearly empty after the digestion of a meal, and this pain is relieved by food, it is often desirable to increase the number of meals and decrease the quantity of each meal. A satisfactory diet in these cases, therefore, would be somewhat as follows: Breakfast, consisting first of fresh fruit, cereals with cream, eggs, and either milk or cocoa; a light luncheon, consisting of milk, bread and butter or sandwiches, at about 11 A.M. and 2 P.M. Dinner at 6 P.M., consisting of soup, preferably a vegetable purée and not a meat stock, which may or may not be preceded by grapefruit, oysters, or some similar dish, one of the light meats, chicken, lamb, or fish, several vegetables, followed by a light dessert, such as junket, cornstarch, rice pudding and the like, and a glass of milk with some crackers before bedtime. The quantity of each meal or luncheon should be varied according to the condition of the patient. Those too fat should be given less, those whose weight is below normal should be given considerably more. If the patient is apt to awaken in the night with pain it is desirable to have a few crackers and a glass of water or milk placed at the bedside. If dinner is taken in the middle of the day the eleven o'clock luncheon may be omitted unless breakfast is very early, but the afternoon luncheon about four o'clock then becomes desirable and the supper should be light, followed by the luncheon before bedtime as before.

If the nutrition is seriously impaired in addition to the diet the patient should be given a rest cure. It may be partial or absolute, according to the degree of emaciation. If partial, it should alternate with a moderate amount of exercise. If absolute, it should be supplemented by passive exercise in the form of massage and perhaps electricity. As the patient gradually gains in weight the amount of rest should be diminished and the amount of exercise increased. The best exercises at this stage are open-air games, in which health and duty are forgotten in the interest of the sport. It does not seem to make very much difference what form is used, excepting that it must be one that the patient does with positive enjoyment. Golf, tennis, mountain-climbing, horseback-riding, fishing, canoeing, camping, swimming have all proved desirable. Possibly the most available for men engaged in active business are golf, tennis, and horseback-riding. They should not be carried to the point of exhaustion, but a reasonable degree of fatigue seems to be decidedly beneficial. For most women it seems exceedingly difficult to devise any satisfactory form of exercise. In the larger cities tennis and golf clubs are available. In the smaller places walking and riding seem to be about all that can be achieved.

Atropine is supposed to diminish the secretion of the gastric juice and to relax the pylorus. I must confess that, as a rule, no very definite results are obtained from its employment, and even when it is carried to the physiological limit the gastric contents may still show the same total acidity; nor is there much evidence that gastric motility is increased.

Strychnine is also employed for the purpose of increasing the motility of the stomach. Given in full doses it appears to be of some benefit, and whether it is due to a continual stimulation of the whole body or to any actual influence upon the muscles of the stomach, a certain amount of increased motility may be observed.

For the purpose of neutralizing the gastric secretion the sodium and magnesium salts are the most available. Of the sodium salts, three have been employed therapeutically—the hydrate, the carbonate, and the bicarbonate—and of these it seems to be the consensus of opinion that the bicarbonate is the safest. The official preparation of the hydrate is the liquor sodii hydroxidi, which is a 5 per cent. solution. The dose is from 10 to 15 minims, and should be given well diluted. It may be administered with advantage in milk, in which it forms with the caseine an alkaline albumin, that is not irritating, and in the presence of an acid, readily gives up alkali for neutralizing. It should always be taken immediately after meals, when the stomach contains a considerable amount of food and liquid, so that it will be well diluted. The carbonate of sodium is one of the constituents of the pancreatic juice, and is well tolerated by the tissues, particularly those of the intestines. It has a much higher neutralizing power than has the bicarbonate, and therefore smaller doses may be employed; 5 to 10 grains after meals will often give considerable relief from the discomfort that occurs immediately after taking food. Like the hydrate it may be exhibited in milk, but, as a rule, it is most readily taken in a capsule or a cachet often combined with other drugs. The bicarbonate of soda is the most commonly employed. It may be taken in fairly large doses for long periods of time; indeed, as much as 1 dram after meals, three times a day, has been taken for weeks without apparently causing anything but a good effect. It is rarely necessary to administer it in milk, although it may be taken in that manner, especially at the milk luncheons between meals. The dose varies according to the degree of acidity, but, as a rule, 10 to 20 grains after meals is sufficient. It is often of great advantage to combine it with some aromatic or mild antiseptic oil, such as the oil of gaultheria, the oil of cloves, or the oil of peppermint, and like its sister salt it may be combined with such other drugs as may by the nature of the case be indicated.

R—Ol. gaultheriæ	f ʒss
Extr. nucis vom.	gr. v
Sodii bicarbonat.	ʒv
M. et div. in caps. xxx.	
Sig.—One after each meal.	

Of the salts of magnesia only three possess alkaline properties. They are the heavy and light oxide, and the hydrated magnesia, which, under the name of milk of magnesia, is a proprietary preparation. There is no essential difference in the action of the heavy and light magnesia. The dose is the same, and they may be administered either after or before meals, as they are insoluble excepting in the presence of acid, and therefore do not irritate the mucous membrane. The dose varies with the nature

of the case of from 5 to 20 grains, and may be exhibited either in capsules, cachets, or powder, alone or in combination. Magnesia should not be used unless the patient suffers from constipation. Some of the salts of calcium are also employed. Lime water, an exceedingly mild alkaline, may be mixed with milk and seems to diminish the tendency to the formation of curds. The precipitated carbonate of lime is efficient as an antacid, and is also a mild intestinal astringent, so that it can be used in those cases of hyperchlorhydria associated with diarrhea.

There are two very common complications of hyperchlorhydria which frequently require the use of drugs. These are *constipation* and *fermentation*. Of the laxatives a great number may be employed, probably with more success in this condition than in some associated with intestinal disturbance. The laxative effect of the alkaline magnesium salts has already been mentioned. In addition to these, sulphate of magnesium may be employed. I have been in the habit of giving this in hot concentrated solution before breakfast, using the smallest quantity capable of producing a natural movement, the dose being varied from day to day, and nearly always descending. It is much better, I believe, to give it every day rather than to produce a more vigorous effect two or three times a week. An initial dose of from 2 to 4 drams may be employed, and this dose is readily dissolved in from 3 to 5 drams of water at a temperature of about 110°. As soon as the dose has been swallowed it should be followed by about half a glass of cool water, which will almost entirely relieve the bitter taste. If the initial dose has produced an evacuation, the following day a little less of the salt may be taken. Sodium sulphate and sodium phosphate may be employed in the same manner. Some of the laxative waters, such as Hunyadi Janos and Pluto water, are also efficient. Of the vegetable laxatives, senna and rhubarb are apparently the most satisfactory for continual administration, although cascara is often employed for this purpose.

It is very satisfactory to add extract of rhubarb to the alkaline capsule. Of this from $\frac{1}{2}$ to 5 grains may be required, according to the severity of the case. The extract of cascara may be used to replace the rhubarb in the capsule. It is equally efficient, but more apt apparently to cause griping, but this is really so slight as to be unimportant. A more serious defect is the uncertainty of the dose, different preparations of cascara, possibly even the same preparation at different times, varying a good deal in effectiveness. From $\frac{1}{2}$ to 2 grains in pill or capsule will often have a satisfactory effect. Aloes is very rarely used alone. In some cases the pill of aloes, strychnine, and belladonna may be given in the evening, and serve to replace all other laxatives.

R—Ol. gaultheriæ	f 3ss
Extr. belladonnæ	gr. ij
Extr. rhei	3ss
Magnes. oxid.,	
Sodii bicarb.	āā 3iiss

M. et div. in caps. xxx.
Sig.—One after each meal.

The number of antifermentative medicines are sufficient indication of their inefficiency. It is not that there is a lack of substances which will inhibit bacterial growth without markedly inhibiting the digestive process, but that these substances seem to be particularly inefficient in the stomach contents, possibly on account of the viscosity of the chyme. Thus, benzoate of soda is an excellent preservation *in vitro*, and I have convinced myself by experiments that it does not in the least inhibit the proteolytic activity of pepsin. Nevertheless, I have not observed any definite results when I have administered it to patients suffering from bloating and eructation. Boric acid is equally useless. Of the substances that may be taken without distinct injury to the patient there are the various salicylates. Theoretically it would seem as if they all must act in about the same way because the hydrochloric acid of the gastric juice precipitates the salicylic acid, and it is recombined in the alkaline intestinal juice to form sodium salicylate. Nevertheless, clinical experience has demonstrated that some salts are less irritating than others. Among the most efficient are the methyl salicylate or the oil of gaultheria, which has also carminative properties. Two or three minims may be taken after each meal, but, as a rule, I prefer to add it to the alkaline capsule. Strontium salicylate and aspirin may also be employed. They do not seem to have very much effect. Salol is insoluble in the stomach contents, and, therefore, can be of no benefit. Resorcin is supposed to be actively poisonous to the lower organisms and to arrest fermentation. It has very slight if any effect upon the peptic digestion. It is very soluble, and, in medicinal doses, practically without toxicity, and is easily administered in capsules, and seems to be the most efficient drug that we have for the partial arrest of fermentation. The dose is from 3 to 5 grains, taken immediately after meals. From time to time it has been used for gastric lavage, with the idea of destroying the organisms that cause fermentation. This is dangerous, and in children it has caused death, and, therefore, should not be attempted. Carbolic acid is also an antiseptic of considerable power. It has the disadvantage of being exceedingly poisonous and of inhibiting peptic digestion. In small doses, however, it sometimes gives relief, and this is probably due as much to its anesthetic as to its antiseptic power. The dose is from $\frac{1}{2}$ to 1 grain after meals. It may be given either in capsule or in solution, but the former seems preferable. The usual precautions should be observed, and the drug should never be given unless there is proof that the kidneys are sound. Creosote is also a powerful antiseptic. It is far less poisonous than carbolic acid, is less irritating to the kidneys, and appears to have some peculiar effect on the gastric mucous membrane that stimulates the appetite, at least this has been claimed as one of its advantages in tuberculosis. The dose varies from 2 to 5 drops in capsules or on a lump of sugar after each meal.

R̄—Ol. menthæ pip.	f℥ss
Resorcin	℥iiss
Sodii bicarbonat.	℥v
M. et div. in caps. xxx.	
Sig.—One after each meal.	

Of the other antiseptics, thymol, beta-naphthol, and menthol, only the latter appears to be of any particular value in the gastric contents, and its effect is more that of a carminative than an antiseptic. My personal preference, while not following any routine formula in these cases, is a capsule whose base is 1 minim of the oil of gaultheria, and 10 grains of either bicarbonate of soda or magnesium oxide, according as a laxative is needed or not. To this may be added 3 grains of resorcin if there is much fermentation, a small amount of atropine, and perhaps a vegetable laxative, either the extract of rhubarb or the extract of cascara.

If the pain is severe some measures must be taken to relieve it. Most patients resort to external applications, but in the majority of cases these are only of temporary benefit. Continuous cold serves only in the acute cases, and gives no lasting results. Of the internal remedies we have two groups, the anesthetics and the protectives. Of the former the most potent are cocaine and eucaine, the latter to be preferred on account of its less poisonous qualities; $\frac{1}{8}$ grain in capsule or solution may be given with advantage. It is, of course, not to be used in cases of persistent pain, but only when severe paroxysms occur from time to time, and it is to be stopped absolutely if there is the least suspicion that the patient is becoming habituated to its use. The milder local anesthetics, menthol, carbolic acid, etc., are of comparatively little value, but in those cases in which the discomfort is very slight they may serve to neutralize it. Nitrate of silver appears to relieve pain in some peculiar manner. Its use was formerly much more general than it is now, and not infrequently cases of argyria are found to have been treated for some gastric disorder twenty years or more ago. It has not been my experience that its use has been followed by the relief that is ascribed to it, and of late years I do not think I have prescribed it at all. The dose should not exceed $\frac{1}{4}$ grain in pill form three times a day. Of the protectives, bismuth is practically the only one that is certainly efficient, and the subnitrate and the subcarbonate may be given in an alkaline powder or administered separately before meals, with the idea of coating any raw surfaces of the mucous membrane. A dose of 10 to 20 grains may be employed in this way. I have sometimes thought that relief has also been obtained by the administration of petroleum ointment, but I have never seen such beneficial results as I have from bismuth.

R \bar{y} —Ol. menthæ pip. f $\bar{3}$ ss
 Bismuthi subcarb.,
 Sodii bicarbonat. āā 3x
 M. et div. in chart. xxx.
 Sig.—One after each meal.

Vomiting is a complication that occurs in two forms. It may be either forced or voluntary. Forced vomiting, as a rule, occurs only occasionally, particularly after a heavy meal, and is preceded by a half-hour or more of discomfort. The attacks vary a good deal in nature, and sometimes there will be vomiting for a day or two and then almost complete relief perhaps for several weeks. The vomitus is always intensely sour, and often followed by violent unproductive retching. Usually, after the evacuation of the stomach, the patient is relieved for a time at

least. Voluntary vomiting is very different. Many of these patients find that discomfort is relieved as soon as the stomach contents are expelled, and they therefore induce vomiting either by thrusting the finger down the throat or sometimes simply by peculiar movements of the root of the tongue. As a rule, only a moderate amount is brought up at each effort, but it is continued until enough of the stomach contents have been removed to afford relief.

Somewhat akin to voluntary vomiting is the habitual use of the stomach tube, to which I have already referred. The forced vomiting is sometimes difficult to control. The patient should take smaller meals, perhaps at more frequent intervals, and if the occurrence of an attack is suspected it may be desirable to restrict the diet for a day or two. Sometimes some of the drugs recommended as anesthetics or antiemetics are of value, and in severe cases I have found that a mixture of eucaïne, cerium oxalate, and charcoal, given in capsule, is successful in aborting the attacks.

R \bar{y} —Beta-eucaïne	gr. ij
Cerii oxalat.	5j
Carbo ligni	gr. c
M. et div. in caps. xx.	
Sig.—One every two hours if required.	

Sometimes resorting to lavage when the patient believes an attack is coming on will relieve the stomach of a large amount of acid mucus and prevent vomiting from occurring. The general treatment of the condition also has a tendency to diminish the frequency and the severity of the attacks. Patients accustomed to relieve themselves dislike very much to be deprived of this privilege. Therefore, they are apt to prevaricate and will persist in producing emesis, although they assure their physician that they do not or they will say they have endured the discomfort as long as possible before seeking relief. The injury caused by this method is not apparently very great. The disadvantage is that it is apt to interfere seriously with nutrition, and always interferes quite seriously with treatment. The capsule before mentioned in voluntary vomiting will often give enough relief to enable the period of discomfort to be endured, but it is probably better to omit the eucaïne for fear they will become accustomed to it.

If a nurse can be employed during the treatment it is fairly easy to prevent the use of the finger; but those individuals who can vomit easily without irritating the pharynx are difficult to control. Persuasion, perhaps aided by some light diversion or occupation about the time the vomiting usually occurs, will often accomplish more than anything else, and if the patient improves moderately under the treatment the inclination may be to a large extent overcome. The tube users must be urged to discontinue their practice at once. If possible the tube should be taken away. In the two cases I have seen of this condition it was possible to accomplish this, and at the end of a week both patients said they felt much better than they had for a long time, and that the inclination to use the tube had ceased. One case was under occasional observation for two years, and assured me that during that time he had practically discontinued lavage, having used it not more than three times. As he had

used it about three times a day previously, this represented an enormous gain. The other patient was only under observation for a few months, and during that time she said that she did not use the tube at all.

Hypochlorhydria as an uncomplicated lesion is exceedingly rare. It appears to be most common in women who are approaching the menopause, and is often associated with a state of nervous depression which may be the causative factor. It also occurs as a complication in chronic gastric catarrh, in profound anemia, and in various cachectic conditions. It is rather difficult to recognize, because frequently patients whose total acidity is somewhat below normal may have apparently perfect digestion as long as free hydrochloric acid is present, and, indeed, if the proteids are saturated with acid there is no reason to suppose that the peptic digestion will be inadequate. It is of importance to eliminate any causative factor, for the treatment will be a failure until the cause has been removed, if this is possible. The cachexias and anemias are easily recognized, and the treatment can be directed to their relief. The early stages of carcinoma are probably by our present methods not to be detected.

In profound anemia the administration of iron, arsenic, or whatever else may be indicated, even perhaps the transfusion of blood, is to be considered. In cachexia, fresh air, rest, hypernutrition, are all indicated. If there is gastric catarrh, treatment should be directed to its correction, with little reference to the percentage of hydrochloric acid. If carcinoma can be recognized or even seriously suspected, operation should not be delayed. If no definite cause can be found, treatment can be directed particularly to the correction of the gastric secretion, and this is rather obviously achieved by the administration of hydrochloric acid. The method of administration varies considerably, but the essential feature in this administration is that the patient should receive at least enough. It appears to be a well-established idea that 10 drops of the dilute acid, which is 10 per cent. pure anhydrous hydrochloric acid, is an adequate dose; but when it is considered that it is diluted by the gastric contents, which are not often less than a pint and frequently considerably more, it appears that it increases the total acidity of the gastric contents rarely more than 0.013 per cent., and is wholly inadequate, particularly if it is administered after meals. Jaworsky, in his experimental work on *achylia gastrica*, was in the habit of pouring into the fasting stomach two or three hundred cubic centimeters of a decinormal hydrochloric acid solution, and no discomfort was thereby produced. I have repeated this test in several cases with the same result; that is to say, that the patient felt no discomfort with this quantity of acid in the stomach. If, therefore, the peptic digestion is somewhat diminished, it would seem wise to give more hydrochloric acid, and to give it before meals, with the idea of stimulating to the utmost the gastric secretion. For this purpose about 20 minims of the dilute acid dissolved in about 4 ounces of water may be given before each meal. The acid serves also to diminish the putrefactive changes. Dr. J. C. Gittings, at my request, performed a series of experiments upon milk to which hydrochloric acid was added in order to determine its inhibiting power on the growth of bacteria and its destructive power even in milk artificially infected with various germs, such as the colon bacillus. He

found that it was actively destructive to bacteria. It is probable that the same is true of the gastric contents. It can be taken satisfactorily over long periods in a mixture with some aromatic tincture, such as cardamom. I have also derived much advantage by combining it with milk and allowing the patient to take as much hydrochloric acid in eight ounces of milk as would barely produce a slight discoloration upon a piece of Congo paper. From 18 to 30 minims of the dilute acid are usually sufficient for this purpose. It gives the milk a slightly acid taste, which is personally agreeable to me, and to which none of my patients have objected. Theoretically there should be considerable advantage in the fact that the proteid in the milk has already been converted into syntonin before it enters the stomach, and is prepared for digestion by any pepsin that may be present. A still further advantage, which is less theoretical, is that in this condition the casein is partially precipitated into exceedingly fine curds, and that the addition of rennet does not alter their size or their consistency. Therefore, the coagulated proteid presents the maximum surface to the action of the pepsin.

R \bar{y} —Acidi hydrochlorici dil.	f 3j
Tinct. nucis vom.	f 3ss
Elix. aromat.	q. s. ad f 3iij—M.

Sig.—f 3j in water before meals.

Of the other drugs, the only ones to affect the stomach are the bitter tonics, nux vomica, condurango, cardamom, etc. They may be administered with hydrochloric acid in the usual dose. Laxatives may be required. Not infrequently these patients have a slight diarrhea, for which I found the tannates and gallates most efficient. If a laxative is needed, cascara can be satisfactorily used with hydrochloric acid. The principle underlying the dietetics of this condition is that the patient should take as much food as possible without causing discomfort. The amount that can be taken varies extraordinarily. One of my cases under observation for a number of years was able to take only about one quart of milk and some crackers or cereal every day. She was an elderly woman of sedentary habits, and although the total number of calories rarely exceeded one thousand in twenty-four hours, and often were considerably less, she gained a great deal of weight. At the other extreme was an emaciated anemic woman, passing through the climacterium, who was able to digest and utilize from four thousand to six thousand calories every day, and not only suffered no discomfort, but gained rapidly in weight and strength, and was ultimately restored apparently to perfect health, with a normal gastric secretion. In general the least digestible articles of food should be omitted, particularly pastry, fancy salads, rich desserts; but it seems desirable to give meats, particularly meat extracts in the form of stock soups, and condiments are not contraindicated.

The treatment of *achylia gastrica* does not differ in any respect from that of sub- and anacidity. The administration of scale pepsin, even in large doses, 20 to 30 grains, with hydrochloric acid after meals, which theoretically should be of advantage, has not in my experience relieved the symptoms, improved the nutrition, nor added to the digestive activity of the gastric juice.

ACUTE CATARRHAL GASTRITIS.

Acute catarrhal gastritis is the response of the gastric mucosa to some irritant either introduced into the stomach or possibly circulating in the blood. The commonest causes are, of course, irritants produced by errors in diet, which include overeating, foodstuffs that may have undergone various forms of decomposition, or excessive indulgence in irritating substances, such as alcohol or highly seasoned substances, or the administration of various irritating drugs. There is usually pain, nausea, and in the severer cases violent emesis, fever, and extreme prostration. In the milder cases starvation for twenty-four hours appears to be sufficient. The patient should take nothing by the mouth excepting small particles of ice, which should be swallowed whole. The thirst may be relieved by enteroclysis. Cold or hot applications may be made over the stomach, and the latter is decidedly more soothing. Mild laxatives may be given. Probably the safest is the oxide of magnesia or the milk of magnesia. Castor oil is also safe, and calomel or blue mass may be used in those cases in which there is no possibility of mercurial gastritis having occurred. Ordinarily, recovery is prompt, but during the second day the diet should be mild, and probably the best food is peptonized milk or albumin water. If the case is more severe, the vomiting may be obstinate and seriously menace life. The patient should be kept in bed, ice applied to the stomach, and, if there is much fever, an ice-bag to the head and a cool sponge given to reduce the temperature. If there is vomiting, no food should be taken by the mouth, and even the ice pills often contribute to the exhaustion of the patient by producing retching. In these cases eucaïne and carbolic acid may be given with advantage— $\frac{1}{8}$ gr. of eucaïne repeated every hour for two or three doses, or $\frac{1}{2}$ gr. carbolic acid in a dram of peppermint water in the same way. If neither of these gives relief in a few hours it is probably best to discontinue their use. It is often of advantage to wash the stomach, and this sometimes checks the vomiting at once, and the symptoms afterward rapidly subside. Water at 100° should be used, and not more than 8 ounces introduced at a time and siphoned off as rapidly as possible. At the same time enteroclysis should be given, and it is sometimes desirable to precede it with a cleansing enema, to which it is desirable to add a moderate amount of glycerin. When the irritability of the stomach has become moderately diminished, certain sedatives may be employed, particularly the salts of bismuth. The subcarbonate appears to be the most efficient, and should be given in full doses, preferably in suspension.

R—Bismuthi subcarbonatis,
 Pulveris acaciæ āā ʒiv
 Aquæ f ʒ vi—M.
 Sig.—f ʒ ij every half-hour.

Small amounts of lime water may also be used with advantage. If the vomiting persists the question of the employment of morphine must be considered, and in a few cases it is undoubtedly indispensable, enabling

the patient to rest, if only for a brief period. Under these circumstances it is also necessary to maintain the nutrition, which can only be done by nutrient enemata. If there is suspicion of renal involvement, either as the cause of the gastritis or as a contributing factor, a hot pack will often relieve the condition; and in certain cases, particularly patients of the full-blooded type, venesection may also be of advantage. After the attacks subside the question of feeding becomes of importance. While there is still some nausea, small doses of ice-cold champagne are often well borne. The initial dose should not be more than 1 dram, and this may be repeated if well tolerated, increasing the quantity and decreasing the interval. At the same time it is desirable to give more nutritious foods—either a milk sugar, egg albumen mixture, whey, and seltzer water, peptonized water, or skim milk and lime water. Of these preparations it is well to begin with 1 dram, increasing the quantity if no nausea follows their administration. Beef tea may then be employed, and to this small cubes of well-soaked toast may be added as soon as the nausea has completely ceased. The question of the administration of purgatives in these conditions is always difficult. Occasionally fractional doses of calomel will relieve the nausea and make the patient feel more comfortable, but occasionally there is some increase of the irritation. In children, castor oil is still often used with decided benefit, but in adults it usually seems to increase the nausea and vomiting, at least in the severer cases.

CHRONIC GASTRITIS.

This is ordinarily a complication of some other gastric disorder, such as hyperchlorhydria, ulcer, carcinoma, and it occurs in various chronic poisonings. It may also be associated with defective dentition and it is quite common in various passive congestions, such as cirrhosis of the liver, valvular heart disease, and in certain toxic states, as in nephritis and diabetes. The most essential part of the treatment is the removal of the chief or contributing factor, if this can be done. Defective dentition should be corrected by a dentist. If there are carious roots they should be extracted. If there is an incurable pyorrhea alveolaris the teeth must be extracted. The restoration of compensation in heart disease, the relief, if possible, of passive congestion in liver disease, and appropriate treatment for nephritis or diabetes are often alone sufficient to restore the stomach to its normal condition. The motility and secretion of the stomach must be carefully studied and, as far as possible, corrected. The diet should be of a light assimilable character, and it may be necessary to restrict the patient for a considerable time to peptonized milk or buttermilk. The former is chiefly useful in those cases in which there is an excess of acid, and the latter in those cases in which there is a deficit. Occasionally, where the appetite is defective and the digestion apparently fair, the bitter tonics may be employed. In chronic cases with much mucus lavage is often of great benefit. It should not be repeated too often, perhaps two or three times a week, although

occasionally it may be necessary every morning or every evening in order thoroughly to cleanse the stomach and prepare it for the assimilation of food.

ULCER OF THE STOMACH.

From the standpoint of treatment, ulcer of the stomach may be divided into four types: (1) Those in which the symptoms consist solely of pain usually coming on at a more or less definite period after eating and perhaps the presence of occult blood; (2) those in which repeated diffuse hemorrhages occur, giving rise to a serious degree of secondary anemia; (3) the chronic ulcer in which, as a result of cicatricial contraction, more or less severe obstructive symptoms are produced, frequently associated with distress; and (4) the perforating gastric ulcer, a condition that usually occurs as a complication of the first form mentioned, but more rarely may occur in either of the others. The diagnosis of gastric ulcer depends upon a variety of symptoms none of which are pathognomonic, but whose combination frequently enables the diagnosis to be made without difficulty.

The object of treatment is to cause healing of the ulcer. Symptomatically it is desirable to relieve the pain, and, if there is any degree of secondary anemia, to check the hemorrhage and improve the condition of the blood. To promote the healing of the ulcer four methods have been advocated: (1) Local application of drugs; (2) placing the stomach at absolute rest by starvation; (3) stimulating the nutrition of the patient so that the ordinary reparative processes of nature have an opportunity to bring about either a restoration of the mucous membrane or the cicatrization of the site of the ulcer; and (4) promoting the evacuation of the stomach contents into the intestines, so that the injurious effects of the chyme are to a certain extent avoided or neutralized. In addition we have the radical method of cure, which consists of the excision of the ulcer. Practically all systematic cures involve the employment of more than one of these procedures at the same time.

Of the drugs supposed to act directly upon the ulcer the most important are the salts of bismuth. This was recorded apparently first by Odier, in 1786. In more recent times it has been particularly advocated by Kussmaul, Fleiner, von Leube, Ewald, Lion. The object of the treatment is to produce a coating of bismuth upon the surface of the ulcer, which protects it from the injurious action of the gastric juice, and in that way promotes healing. A secondary desirable effect is the temporary relief of pain. Fleiner recommends the following procedure:

In the morning the stomach is thoroughly washed until the water returns practically clear through the tube. Then from 10 to 20 grams of subnitrate of bismuth are rapidly stirred in about 200 c.c. of lukewarm water and poured into the funnel, followed by about 50 c.c. of water, for the purpose of washing into the stomach the bismuth that may have adhered to the sides of the tube. The patient then assumes a position which will permit the bismuth to subside upon the surface of the ulcer; that is, if the ulcer is on the posterior wall, he remains flat upon his back; if upon the anterior wall, he lies flat upon the abdomen; if the ulcer, as

is usually the case, is near the pylorus, he should assume either a semi-erect posture or lie upon the right side. In about fifteen minutes the bismuth should have subsided so completely that the supernatant water can be allowed to flow back through the stomach tube, which is then withdrawn. The patient then remains resting for half an hour, and finally receives his breakfast. This is to be repeated at first daily, then every other day, and finally at long intervals. The immediate result of the treatment is the relief of pain. The ultimate results are supposed to be a cicatrization of the ulcer and the cure of the patient.

Instead of bismuth subnitrate, bismuth subcarbonate may be employed. Boas believes that it is less constipating than the former drug. The experience with the use of huge doses of bismuth as a preparation for *x*-ray pictures seems, however, to prove that bismuth has very little effect in inhibiting peristalsis of the intestines. Other substances, such as talcum powder, have been employed, but apparently are, in all respects, less valuable. Experiments upon animals have shown that in the normal stomach the bismuth is pretty uniformly distributed over the mucous membrane. If, however, a superficial erosion or a deep ulcer have been artificially produced the bismuth will form a crust completely covering the lesion and apparently protecting it from any external injury. If the employment of the stomach tube is for any reason contraindicated, the treatment may be modified by permitting the patient to drink about 10 grams of subnitrate of bismuth that has been vigorously stirred into a glass of warm water. Nitrate of silver has also been highly recommended, particularly by Gerhardt. This may be given either in liquid form, about 1 dram of a solution of 2 grains to the ounce, or $\frac{1}{4}$ grain pills. Obviously the greater portion of the solution will be precipitated by the time it reaches the stomach, and if any of the nitrate of silver actually does reach the stomach it will then immediately be precipitated by the gastric juice. It must, however, be equally true that when the nitrate of silver in pill form is dissolved it also is precipitated as a chloride of silver, and that the likelihood of any of the silver in an astringent form reaching the surface of the ulcer is exceedingly slight. The silver is, of course, more efficient if given upon an empty stomach, and therefore should be administered only before meals, usually about three times a day. The usual effect of the treatment is to diminish the pain, and it is possible that in very mild forms of ulceration recovery may occur.

Olive oil has also been employed. It must be administered to the empty stomach in fairly large doses, and usually through the stomach tube. After washing the stomach and emptying it as nearly as possible of its contents, from 100 to 200 c.c. of olive oil are introduced. Apparently it acts in five ways: (1) By facilitating the evacuation of the stomach contents; (2) by diminishing the secretion of the gastric juice; (3) by protecting the surface of the ulcer from the acid of the gastric juice which does not mix with the oil; (4) by improving the nutrition of the patient, olive oil being the most concentrated form of nourishment known; (5) by promoting the regurgitation of the duodenal contents, thus partly neutralizing the chyme. Subjectively it usually relieves pain promptly. Von Tabora, who edited the second part of Riegel's second edition,

advises the employment of olive oil with bismuth, suspending the bismuth in the oil and allowing the mixture to remain in the stomach.

Of the other medicinal remedies may be mentioned alkalies, given solely for the purpose of neutralizing the acid in the gastric juice, and in the same manner as they are employed in hyperchlorhydria, and alkaline laxative mineral waters that contain sodium chloride and which are supposed to fill a variety of indications, but undoubtedly act chiefly by the neutralization of the gastric juice. Magnesium, particularly magnesium oxide, which acts both as a neutralizing salt and a laxative, is also of benefit. All these, of course, are most efficient given after meals, although the fact that bicarbonate of soda will inhibit the secretion of gastric juice suggests that it may be equally useful on a fasting stomach. I have often used a 5 per cent. solution of bicarbonate of soda for the purpose of washing out the stomach. Atropine or belladonna meets three indications: It diminishes the secretion of the gastric juice, promotes the relaxation of the pylorus and the evacuation of the gastric contents, and relieves pain. Whether the third action is merely a consequence of the other two or not is not certain. It may be given in solution or preferably in pill form. Rarely is it necessary to give it hypodermically. Small doses are probably best, not more than $\frac{1}{200}$ grain two or three times a day, and even less if any of the physiological symptoms are manifested. The preparations of belladonna apparently vary a good deal in efficiency, but from $\frac{1}{16}$ to $\frac{1}{8}$ grain of the solid extract or from 5 to 10 minims of the tincture may be administered. It must be remembered, however, that atropine is chiefly valuable in association with some of the other methods of treatment.

Of the other drugs the most important that has been recommended is chloroform. It may be regarded as a carminative, and perhaps, in a slight degree, as an antiseptic. Lavage with a 2 per cent. solution of chloride of iron has also been advised. This should be repeated daily for five days and its benefit is not supposed to be dependent wholly upon its stypic action.

The second method of treatment is putting the stomach at rest. The principle of this method is starvation, and the only variation is in the degree of starvation and the methods of attempting to supply as much nourishment as possible in other ways. Essentially the treatment consists of putting the patient at rest. This means not only rest in bed in a horizontal position, but also the avoidance of massage, electrical stimulation, and all other methods that increase internal metabolism, and, therefore, require a greater amount of nourishment. Mental rest is also important, and these patients often require a moderately strict degree of isolation. At the beginning of the cure, at least, all nourishment by mouth should be withheld, and even water should be taken sparingly or not at all. Thirst may be relieved by small particles of ice, which are to be swallowed whole. Nourishment should be given almost exclusively by the rectum, and for this purpose various nutrient enemas have been advised and employed. Thirst may be relieved by enteroclysis, and it has seemed to me that physiological salt solution is neither theoretically nor practically desirable for this purpose. Plain water is best unless it pro-

duces, as is sometimes the case, a slight degree of irritation, that renders its retention difficult. Under these circumstances the half-strength physiological salt solution recommended by Crile appears to be eminently satisfactory. Whether oil inunctions or the hypodermic administration of oil are of any value in these cases or not is still a much disputed question. There can be no doubt, however, that if they are of any value it is so slight that their omission does not seriously involve the nutrition of the patient.

The method of employing the *rectal nutrition* varies a good deal in the hands of different practitioners. As a general rule, the enemas consist of eggs and milk that have either been predigested by some of the pancreatic preparations on the market, or to which these preparations have been added, with the idea that digestion will subsequently take place in the colon. To this combination carbohydrates in the form of sugar may be added with advantage, and even starch has been employed, with the idea that it will be broken up into sugars either by the ferments or the bacteria of the colon. The solution should not be too concentrated. It is important in all cases, as the experiments of Grutzner and Hemmeter have shown, to add sodium chloride in quantities sufficient to make the resulting solution about 0.7 per cent; that is of physiological strength. It may also be of advantage, but this is doubtful, to add small quantities of some antiseptic, such as thymol or menthol.

It is obvious that if we could construct our nutrient enemas of readily absorbable substances that do not require predigestion, and of such a nature that the enema can be sterilized before administration; and if, moreover, these substances have very little irritating effect, if any, on the bowel, we would be able to administer not only a greater amount of nourishment, but to have a large portion of that nourishment utilized with very little danger to the patient. It seems to me that these conditions are almost perfectly fulfilled by the nutrient enema recommended by Wegele. This consists of 25 grams of Witte's peptone and 25 grams of sugar of milk, dissolved in 500 c.c. of water. Practically almost an identical solution is obtained by using an ounce of peptone and an ounce of sugar or milk dissolved in a pint of water. The mixture is, of course, made easily and accurately by an inexperienced person. It should then be brought to a boil for the purpose of sterilization and allowed to cool to 100°, at which temperature it is slowly injected into the rectum. The total value in calories of this mixture is about 250, and as many as four can be given in a day without undue irritation, providing the rectum is healthy. The patient, therefore, may receive as much as 1000 calories, providing, of course, the total nutrient value of the enema is assimilated, which probably is never the case, and two quarts of water, an amount sufficient to relieve the thirst. If there is any tendency to irritation after the enema is injected, 1 dram of sodium chloride may be added, but usually it is not necessary. Both the Witte's peptone, which is really an albuminose, and the sugar of milk are readily absorbed by the mucous membrane without further preparation by ferments. Sharpi recommends a somewhat similar formula. As a rule, the nutrient enema should be preceded by a cleansing enema. Should, however, three or four nutrient

enemas be given in the course of a day, if each were to be preceded by another enema, the amount of mechanical irritation to the colon would soon render that organ intolerant, and it is better to give a single cleansing enema in the morning.

The third method attempts to promote the cure of ulcer by improving the nutrition of the patient. This has been chiefly advocated by Lennhartz, whose favorable results have been confirmed by various clinicians, particularly Lambert.

A careful routine is followed for a period of two weeks and the food is administered as cold as possible. A schedule for the fourteen days, as adapted by Lambert to the American dietary, is as follows:

Day.	Eggs.	Milk.	Sugar.	Scraped beef.
I	2 drams each dose; total, 2 eggs	4 drams each dose; total, 6 oz.		
II	3 drams per dose; total, 3 eggs	6 drams per dose; total, 10 oz.		
III	$\frac{1}{2}$ oz. per dose; total, 4 eggs	1 oz. per dose; total, 13 oz.	20 grams added to eggs	
IV	5 drams per dose; total, 5 eggs	$1\frac{1}{2}$ oz. per dose; total, 1 pt.	20 grams added to eggs	
V	6 drams per dose; total, 6 eggs	14 drams per dose; total, 19 oz.	30 grams	
VI	7 drams per dose; total, 7 eggs	2 oz. per dose; total, 22 oz.	40 grams	36 grams in 3 doses.
VII	4 drams per dose; total, 4 eggs; also 1 soft-boiled egg every 4 hrs.; total, 4 eggs	2 oz. per dose; total, 25 oz.	40 grams	70 grams, with boiled rice; 100 grams in 3 doses.
VIII	4 drams per dose; total, 4 eggs; also 1 soft-boiled egg every 4 hrs.; total, 4 eggs	$2\frac{1}{2}$ oz. per dose; total, 28 oz.	40 grams	70 grams, with boiled rice; 100 grams in 8 doses.
IX	.....	3 oz. per dose; total, 1 qt.	.....	Beef same; rice, 200 grams; zwieback, 40 grams, in 2 portions.
X	4 drams per dose; total, 4 eggs; also 1 soft-boiled egg every 4 hrs.; total, 4 eggs	Add cooked, chopped chicken, 50 grams; also butter, 20 grams	40 grams	Beef same; rice, 200 grams; zwieback, 40 grams, in 2 portions.

XI-XIV—Interval of feeding made two hours; milk given in 6 oz. doses, with $\frac{1}{2}$ oz. raw egg; butter increased to 40 grams and various additions made as detailed above.

I have been accustomed to follow the same general principle, with some modification of the diet, as given in the table. I begin with a mixture of egg white and milk of sugar, given cold, and 1 dram of olive oil, given two or three times a day. The albumin solution consists of the whites of two eggs and one ounce of milk sugar in a pint of water, and of this four ounces may be given every two hours. The quantity is rapidly increased as the tolerance of the patient improves, and to it is later added a small quantity of 16 per cent. cream, so that on the third day the mixture consists of cream, 1 ounce; egg albumen, 2 ounces; sugar of milk, 1 ounce; and enough water to make 1 pint. Of this, 4 to 6 ounces can be given every two hours. On the fifth day an additional ounce of cream is added, and the diet is then increased according to the relief from pain and the ability of the patient to tolerate it. As a rule, there are no signs of intolerance, and the pain diminishes as soon as it is commenced. After this peptonized milk, malted milk, egg beaten up in milk, junket, cornstarch, and custards may be given, to be followed by milk toast, oyster broth, twice-cooked breads thoroughly softened or thoroughly chewed, baked potato, scraped meat, mashed white meat of chicken, until the patient is taking a full and amply nutritious diet. At the same time the various drugs already mentioned may be given, and particularly the bicarbonate of soda and bismuth. If during the treatment there is an increase in the pain the diet should be reduced at once to that of the beginning, and then cautiously increased again. At the same time the patient should rest in bed and a light, general massage given daily, omitting entirely the massage of the abdomen.

For promoting the evacuation of the stomach contents into the intestines all those methods advocated for submotility and pyloric obstruction may be employed. In addition the necessity of gastro-enterostomy must be considered. The early enthusiasm exhibited by some surgeons for this operation has been very greatly diminished in the last year or two, since it has been shown that the ultimate results are not invariably as favorable as the immediate results, and, indeed, in many cases a relapse occurs in the course of a few months. It must not be forgotten, however, that in serious cases of ulcer the immediate relief afforded is great, and gives an opportunity to improve the nutrition of the patient. The chief difficulty of the operation appears to be the gradual closure of the opening, so that the condition becomes the same as in the beginning. This happened certainly in one of my cases, because at a second operation the original gastro-enterostomy barely admitted a fine probe. This patient had a particularly large ulcer, and before the second operation her condition was as bad as in the beginning, and one year after the second operation there has been a further but not quite so serious a relapse.

A second difficulty is the possibility of the formation of a vicious circle. This, I believe, is due invariably to the formation of adhesions that cause obstruction either between the ampulla and the artificial opening or beyond the artificial opening. In one of my cases this vicious circle was of such a severe character that in spite of a second

operation it caused death, and in another six subsequent operations failed to relieve it entirely.

Excision of the ulcer is chiefly of advantage by enabling the surgeon so to arrange the scar that there will be no subsequent obstruction, and in removing a considerable amount of tissue that experience has shown may ultimately undergo malignant transformation.

Complications of gastric ulcer are numerous and grave. The first is the occurrence of profuse *hemorrhage*. The patient may suddenly become pale and vomit a large amount of blood, perhaps a pint or more, and later discharge a great amount of altered blood by the bowel.

The treatment consists of putting the patient absolutely at rest, permitting nothing to enter the stomach, giving enough morphine to maintain a mild stuporous condition, and using gelatin, if any is at hand, hypodermically. At the same time enteroclysis or hypodermoclysis should be employed to restore the quantity of the blood, and even transfusion by vascular anastomosis should be considered if the patient appears to be in danger of death. It is perhaps needless to say that the stomach tube is absolutely contraindicated. If the hemorrhage should recur the question of operation must be considered. Personally, I believe the results are somewhat more favorable without than with operation, although it sometimes is difficult to refrain from some surgical attempt to control the bleeding vessel when considerable quantities of blood are being lost daily. After the hemorrhage has ceased it is absolutely essential to put the patient on rectal feeding and to continue to withhold nourishment by the mouth for several days.

Another complication is the formation of adhesions around the scar between the stomach and adjacent organs. Several remedies have been advised for this condition, of which the only one that appears to be of any use is thiosinamin. It has been confidently maintained by several writers that this substance injected hypodermically destroys scar tissue. Apparently it is harmless, but I have never felt sufficient confidence in its action to employ it, although I have observed several cases in which its employment was practised, and in none of these were definite results apparent. The radical and rational treatment is, of course, a surgical operation, to relieve whatever mechanical obstruction may exist.

The fourth and gravest complication, perforation, is purely a surgical condition.

CARCINOMA OF THE STOMACH.

Carcinoma of the stomach may occur in a variety of forms, giving rise to various indications. It must be remembered that a carcinoma of the wall that does not obstruct and does not bleed produces no symptoms and requires no medical treatment. Indeed, it is rarely discovered until metastasis has taken place. In the majority of cases, however, obstruction occurs, and at the same time hemorrhage and perhaps the disturbance of the gastric secretion contribute to produce considerable emaciation.

The treatment of *carcinoma of the cardia* is the same as the treatment of carcinoma of the lower portion of the esophagus.

The treatment of *carcinoma of the pylorus* presents a variety of features. The main indication is to relieve the obstruction. This is slowly but steadily progressive, giving rise to gastric dilatation, and secondarily to vomiting, malnutrition, and constipation. In the early stages, if for any reason a radical operation cannot be attempted, a certain amount of relief may be obtained from lavage, and in severe cases, where an operation cannot be attempted, it may even be performed before each meal. Nutrient enemas may also be employed, giving preferably not more than one a day, because they must be continued over a considerable period of time. It is doubtful whether hydrochloric acid is of much benefit. The gastric contents show, as a rule, but not invariably, all the characteristics of achylia, and the experimental administration of hydrochloric acid should theoretically increase peptic activity, which should be of advantage, but it has not seemed to me that the empirical results were satisfactory. If there is occult or visible blood in the lavage or occult blood in the stool, some measure to combat the hemorrhage, such as the administration of bismuth, charcoal, iron, or calcium, may be tried. Although I have described these measures they should rarely be employed, because the moment obstruction can be recognized an operation should be performed, radical if possible, and if not, at least a gastro-enterostomy. The benefit following either of these operations is often great. The patient immediately begins to gain weight and strength, and for several months feels perfectly well. It has not been my good fortune to observe any case in which recurrence failed to take place, but enough successes have been reported to encourage us invariably to recommend the radical operation.

Carcinoma of the wall of the stomach not producing obstruction may cause merely symptoms of indigestion, with the picture of achylia gastrica.

In these cases internal treatment is of some temporary avail. In addition to hydrochloric acid some of the bitter stomachics are of value, and among these condurango has held a position of some eminence. It must be remembered, however, that it merely serves to stimulate the appetite, and if it fails to do this it is useless. There appears to be no standard strength for the preparation, and the dose, therefore, varies extraordinarily, ranging, according to different authorities, from 10 minims to half an ounce. The only symptoms of an overdose is a severe diarrhea, with griping. In this condition lavage is least important; but if there is much hemorrhage, and there usually is, there will be a profound anemia, often causing the case to be mistaken for one of progressive pernicious anemia, and curiously iron and arsenic appear to be of temporary benefit. The presence of occult blood in achylia should always arouse suspicion of a mural gastric carcinoma. The question of operation, of course, arises, and is particularly difficult to decide if the blood count is very low. As improvement, if it occur at all, will be very slight, the question is not of deferring the operation, but of either taking a desperate

chance or abandoning it altogether. In view of the hopelessness of the condition the desperate chance is usually justifiable.

Carcinoma may also produce *hour-glass contraction of the stomach*, a condition that can only be relieved, if at all, by surgical intervention. As physicians we are frequently called upon to diminish the suffering or attempt some desperate remedy for the advanced inoperable case. If there is actual suffering, morphine is the only resource, and must be given in full doses. As remedial measures, there have been suggested the *x-rays*, radium, Coley's fluid, and Hodenpyl's fluid.

At the present time the *x-rays* offer the greatest hope. A few cases have been reported in which apparently it stayed the progress of the disease, at least for a short time. There are, I believe, no recorded cures of gastric carcinoma. My personal experience has been wholly discouraging, no case showing the slightest benefit from the treatment. Radium I have not seen employed. At the present time it seems less efficient than the *x-rays*, and is somewhat more dangerous, so that its use is hardly justifiable. Concerning Coley's fluid, the reports are so variable, and, on the whole, so unfavorable, that it is hardly worth considering, particularly as the mechanical difficulties of introducing it into a gastric carcinoma are practically insuperable.

Hodenpyl's fluid appears to have given good results. Of course, it is in a line with the work of Beebe upon malignant tumors of dogs. As Beebe has been able to cure dogs with far-advanced tumors, there is no reason why malignant tumors in human beings should not be made to undergo retrogression. Unfortunately, this serum, which was obtained from a single case of carcinoma of the peritoneum that was undergoing spontaneous cure, has been exhausted. I have attempted the same thing, however, with a serum obtained from a case of secondary carcinoma of the peritoneum that terminated fatally. This serum was used in preventing the development of tumors in two dogs artificially inoculated, and apparently gave temporary relief in a case of gastric carcinoma upon which a gastro-enterostomy was performed, and a radical operation at that time found to be impossible. In ignorance of how the serum should be employed, I administered it subcutaneously, 5 c.c. once a week. No injurious effect was observed, but the improvement could possibly have been ascribed to the enthusiasm of the patient for the effort being made in his behalf. Eventually he died.

DISEASES OF THE INTESTINES.

ULCER OF THE DUODENUM.

Ulcer of the duodenum is a condition not so very uncommon, but with a rather obscure symptomatology, and, at the present time, no satisfactory treatment. As a rule, it is difficult to differentiate from gastric ulcer excepting that occult blood is not found in the gastric contents and is

found constantly in the feces. However, this is by no means absolute. The treatment that applies to gastric ulcer is usually advised for duodenal ulcer, particularly rest of the stomach and upper part of the intestines, and a light, easily assimilable diet. Probably a reduction in the carbohydrates is of some advantage, as it diminishes the pancreatic secretion, and, indeed, the diet advocated by Wohlgemuth for pancreatic fistula may be tried. Olive oil and bismuth may be of considerable advantage, particularly the latter, and may be given in fairly full doses. The complications are very largely surgical. There may be either a partial stenosis of the duodenum or perforation, which, of course, is purely surgical, and for which there is no medical treatment. The value of gastro-enterostomy in these conditions is considerably more doubtful than it is in gastric ulcer, excepting for those cases in which there is stenosis.

INTESTINAL HEMORRHAGE.

This may vary from the merest traces of occult blood to huge discharges, consisting of blood more or less altered by intestinal digestion. The treatment of copious hemorrhage may be divided into two stages: (1) The active treatment designed to check the immediate discharge; (2) the treatment directed to the cause, with the object of preventing a repetition.

As soon as the hemorrhage is detected it is important to put the patient absolutely at rest. The peristalsis must be checked, and this can only be done satisfactorily by adequate doses of morphine given preferably hypodermically. Codeine is also recommended, but in my experience it is less efficient and possesses no other advantages. In a number of cases I have employed gelatin hypodermically, with apparently excellent results; but for this purpose it is necessary to have the gelatin prepared and carefully sterilized in order to prevent danger of producing tetanus, a number of cases of which have been reported. The preparation is as follows: In ten parts of physiological salt solution one part of gelatin is dissolved by boiling and the solution carefully filtered through paper. It is essential to have it as nearly clear as possible, in order to prevent pain at the site of the injection. It must then be sterilized for three successive days, for one hour, in the steam sterilizer at a temperature of 100° C. In the intervals it must be kept in the incubator in order to promote the development of spores. Ten cubic centimeters of this mixture are melted at a temperature of 38° C., and then injected deeply into the tissues, the injection being repeated once or twice at an interval of twelve to twenty-four hours. If there is any indication that the hemorrhage continues, calcium chloride or calcium lactate may also be given by the mouth in doses of 5 grains four times a day for not more than three days. After the hemorrhage, auscultation of the abdomen should be practised frequently, and if there is undue activity of the peristaltic sounds the morphine must be repeated until they become fairly quiet. It is needless to add that any measures designed to produce an evacua-

tion are to be avoided. Bismuth may also be given in large doses for the purpose of coating any raw or ulcerated surfaces. Operation in these cases is useless unless the exact cause of the hemorrhage can be determined and perhaps a bleeding ulcer excised.

The prophylactic treatment must vary with the condition that causes the hemorrhage if this can be determined. The commonest causes are some ulceration, which may be duodenal, tuberculous, or typhoid; dysentery; the presence of parasites, of sharp foreign bodies, of malignant tumors of the intestines; chronic passive congestion, as in cirrhosis of the liver and valvular heart disease; and certain obscure conditions, some of which are associated with enlargement of the spleen.

Hemorrhage, supposed to occur from microscopic ulceration, may also occur in cachexia, such as that of pernicious anemia, amyloid disease, etc., and in infarctions of the mesentery involving portions of the intestinal wall. It is obvious from this list that the treatment must vary in each particular case and cannot be discussed here at length. If ulceration exists the intestines should be kept as nearly as possible in a state of rest until the ulcers heal, having due regard to the fact that the patient is in a state of starvation and may be dangerously weakened. In any event the food should be of the most assimilable nature and leave the minimum amount of indigestible residue. For this reason, egg albumen, milk, milk sugar, olive oil, and some of the readily digested starches, such as rice, should constitute the main part of the diet. The use of bismuth may also be of some advantage in promoting healing. The intestinal parasites must be destroyed by the measures found most efficient for this purpose. In passive congestion of the intestines the treatment must be directed chiefly to the underlying condition, the portal circulation partly relieved, if possible, by a Talma operation, and cardiac compensation, if it has failed, restored if possible.

In cachexias, whatever measures can be inaugurated to restore the nutrition and improve the condition of the blood are indicated. For infarctions of the mesentery practically nothing can be done, although it is conceivable, providing the lesion be circumscribed, that life might be saved by a surgical operation.

In that rare condition associated with enlarged spleen, for which no definite etiology is known, analogy, with polycythemia might suggest the desirability of treating the spleen with the x -rays, although I have no knowledge that this has ever been attempted.

ACUTE ENTERITIS.

(*Cholera Morbus.*)

This is rather a syndrome than a definite clinical entity. It is the response of the intestinal tract to any severe irritation. There is pain, fever, prostration, usually profuse diarrhea, the movements being liquid and offensive. The irritant may be a drug, a chemical substance, or a bacterial or animal parasite.

The number of drugs that can produce acute enteritis is very large. Those which are actively poisonous, such as bichloride of mercury, must be treated with the usual antidotes, the patient left at rest, and pain allayed by morphine. If the enteritis has been produced by a drug, such, for example, as the salicylates or an overdose of laxatives, the withdrawal of the drug, rest of the patient, and perhaps small doses of some sedative and lavage of the colon with physiological salt solution, are usually sufficient to check the attack.

The infectious forms of acute enteritis are much more difficult to manage. Undoubtedly, if we could differentiate the various bacterial organisms that may produce irritation of the bowel, we would gradually learn a more or less specific therapy. Excepting in a small variety of conditions this is practically impossible, and we are compelled to use various remedial measures in a more or less haphazard manner. Essentially the objects of treatment are: (1) To evacuate the intestinal tract so that there will be as little nutrient media for the microorganisms as possible; (2) by restricting the diet to prevent accumulation of more; (3) to destroy or inhibit the growth of microorganisms that may remain in the intestinal tract; and (4) if necessary to check excessive peristalsis.

The first indication is met by various measures to evacuate the bowels. Of the laxatives, castor oil and the salines have long been popular, castor oil particularly for very young children. The dose varies and should not exceed 4 drams for an adult, and half of this is often efficient. It is conveniently administered in gelatin capsules. Calomel is supposed to have the added advantage of some antiseptic properties, but there is no evidence that these exist. It is, however, an efficient laxative and, properly administered, gentle in its action. At the present day it is customary to administer doses of $\frac{1}{2}$ to 1 grain, giving $\frac{1}{10}$ grain every half-hour or hour until the amount required has been reached. The salines may be taken in a single dose, in a hot concentrated solution, from one to four drams of magnesium sulphate, which is probably the best, or corresponding doses of the other salts. If the attack has lasted for several days and the evacuations have been copious it does not appear that much good can be accomplished by the administration of laxatives.

The diet should be restricted and non-irritating. In the more severe cases the patients should be allowed to drink water, but take no food.

In the less severe cases, albumin water, sterile milk, whey, rice water, and barley water may be employed. Very often in children it is necessary, for the time being, entirely to discard milk in all its forms. In mild forms it may be necessary to give the patient a considerable degree of nourishment, particularly if for any reasons the general physical condition was not good when the attack began. For this purpose buttermilk occasionally forms an excellent diet and seems distinctly to contribute, not only to the nutrition of the patient, but also to control occasionally the infectious process. In addition a light diet may frequently be taken in the mild forms without any apparent detriment. A considerable number of intestinal antiseptics have from time to time been advocated.

Of these some, although efficient *in vitro*, appear to be of no value in the intestinal tract. Others are irritating and therefore unavailable. Of the remaining number it seems fair to say that at present we are unable to determine more than the fact that empirically they occasionally seem to be effective. Various salts of silver in organic combinations have been highly lauded, chiefly by their manufacturers. Many of these are proprietary, and I think it fair to say that their use at the present time has been generally abandoned. Of the other antiseptics, there are three that apparently are efficient, not irritating, and, in moderate doses, not toxic. These are guaiacol, beta-naphthol, and thymol. All these drugs are best administered in capsules. The dose varies from two to five grains three or four times per day, although it must be remembered that five grains of thymol occasionally produce considerable irritation. There appears to be no very marked difference in effect, and the administration may be continued over considerable periods.

Strassberger has devised a method of estimating the total weight of bacteria in the feces and comparing it as a percentage formula with the amount of dried feces; but it does not appear that we are in a position either to obtain constant results by this method or to determine the significance of such results when obtained. Others have regarded the disappearance of the offensive odor as an indication that the active growth of bacterium coli has been inhibited. The most satisfactory test is the reduction in the number of movements, the cessation of the pain, the subsidence of the fever, and the restoration to health. Of the other antiseptics that may be used, salol is efficient, but, on account of the possible irritation of the kidneys, not to be used recklessly, and it has seemed to me, on purely clinical grounds, that its action was less prompt than that of any of the three drugs named in the preceding paragraph.

Resorcin has also been advocated, but is less useful in intestinal than in gastric fermentation. As this may be largely a matter of opinion, and as it is certainly not susceptible of conclusive demonstration, I am far from decrying its use.

Creosote and the sulphocarbolates have also been advocated. The former may be used in from two to five minimum doses three times a day or combined with some of the other antiseptics. I have not convinced myself that it possesses any advantage. The antiseptic action of the bismuth salts is slight, and their use will be considered in connection with the astringents.

Another substance that I have used rather frequently, and to my own satisfaction, is sulphur. This was suggested to me by hearing of the excellent results in acute and chronic enteritis obtained in the Philippines at certain sulphur springs. I have since used this in various cases of acute and chronic enteritis, particularly if the mixture of blood and mucus suggested something more active than merely the bacterium coli in a virulent condition, and often the results were favorable. The dose of precipitated sulphur is 10 grains administered in capsules every three or four hours, and proportionately smaller doses for children. Apparently

it soothes the pain and diminishes the frequency of the bowel movements and the offensive character of the feces.

Sedatives and astringents may be required to subdue the pain and to diminish the depletion caused by excessive serous discharges. For the reduction of the pain the simplest measures are external applications. These may be either warm or cold, the warm acting more promptly and being more soothing, the cold apparently producing slightly more lasting results, although this is reasonably doubtful. For heat there may be employed the hot-water bag, a hot, mild mustard plaster, or turpentine stupes, which produce a certain amount of counterirritation that may be of some value. Warm, moist heat can also be employed in the form of a turkish towel rung out of very hot water and folded so that it covers the anterior surface of the abdomen. For cold the ice-bag is sufficient. The hot-water bag or the ice-cap may be applied continuously. The other three measures must not be carried to the point of producing any local irritation of the skin. If the pain is too severe to be relieved by these measures some form of opium is essential. Morphine is the most trustworthy, but codeine can also be employed in mild cases. Either may be given hypodermically, but they are also efficient if administered by the mouth in slightly larger doses. Enough must be given to relieve the pain. Opium suppositories can be used or tincture of opium and paregoric can be given by the mouth. This will probably rarely be necessary.

Of the astringents, the salts of bismuth, zinc, and copper and the tannates and gallates may be employed. Bismuth is rather a protective than an astringent, and by protecting the mucous membrane inhibits peristalsis and probably thereby diminishes the activity of the intestines. Any of its salts may be used, and the salicylate is mildly antiseptic, but if a distinctly astringent effect is required the subgallate is the best. It is usual to give from 5 to 10 grains every two or three hours, although half an ounce of the subcarbonate or subnitrate may be taken with impunity. Sulphate of copper is also employed occasionally, the dose being $\frac{1}{4}$ grain or less, and the sulphocarbonate of zinc, on account of its supposed antiseptic as well as its astringent qualities, in doses of 2 grains or less two or three times a day. Tannic acid and gallic acid can also be used, and are really as efficient as the proprietary forms, of which there are a number on the market. The dose is 5 to 10 grains in capsule.

Another procedure, which appears to fulfil such a variety of indications that it cannot be included under any one, is lavage of the colon. This serves to evacuate the bowel, to dislodge and remove the mucus, diminishing the culture medium for the bacteria, to soothe pain, to diminish the frequency of the bowel movements, probably by removing a certain amount of irritant material, and to supply the place of serum of the blood which has been drawn off in the discharges. It is exceedingly important in performing this lavage that the temperature of the water be maintained at about 100°, and that its introduction should be very slow. There is no apparent advantage in using the so-called high enemas,

that is, attempting to introduce a rectal tube for from six to eight inches, for Cannon has shown that the reverse peristalsis normal to the colon occurs if the catheter be introduced beyond the inner sphincter. It has seemed to me that the Murphy method of introducing the salt solution is decidedly the best. From time to time intervals must be allowed for the discharge of water, mucus, and fecal matter. From a pint to two quarts may be given at a time, stopping the flow if there are any distinct signs of discomfort. The administration of a pint of warm saline solution in the course of half an hour or an hour, two or three times a day, sometimes acts favorably, and is less annoying to the patient.

The acute diarrheas of childhood also merit mention. Essentially the treatment does not differ from acute diarrheas of adults, excepting that greater care is required in the adjustment of the diet and the greater benefit of lavage of the colon, which is carried out somewhat differently from the method employed in adults. The question of infant feeding cannot be undertaken in this article. I merely mention that it is important to discover the type of indigestion from which the infant suffers, whether it be the proteids, carbohydrates, or fats, and that this substance should accordingly be greatly diminished or omitted altogether. Not infrequently milk must be entirely withdrawn, and I have found in these cases that weak egg albumen solution to which sugar of milk has been added can ordinarily be well borne, and if the infant is given one or two drams of olive oil in the course of the day the caloric value of the food is not greatly diminished. As infants will not retain enemas, the lavage is accomplished by injecting the water from a fountain syringe placed from nine to twelve inches above the level of the rectum. The temperature of the water should be between 100° and 103° F., and as it is allowed to run in from time to time the colon will contract, forcing the water and the colonic contents with considerable force past the tube, and in this way a fairly thorough washing is accomplished.

CHRONIC ENTERITIS.

There are two forms of chronic diarrhea which we sharply differentiate clinically, those in which the nutrition of the patient is greatly impaired and those in which it is not impaired at all, and the patients may even gain in weight, although the diarrhea persists. There has been no definite anatomical basis determined to account for these two clinical types, although it may be said that in the forms in which nutrition is preserved the inflammation is nearly always restricted to the large intestines, and they will be spoken of, therefore, as forms of chronic colitis. Chronic enteritis or diarrhea associated with malnutrition has an exceedingly various etiology. It may be due to a persistent indigestion of some element of the food that has its basis either in a defective secretion of the gastric, pancreatic, or intestinal juice. It may be due to some chronic localized infection, as chronic appendicitis, or it may be the result of a

diffuse infection of the intestinal tract usually associated with the formation of ulcers, or to the presence of intestinal parasites. There are also forms for which no definite etiology can be ascribed, except the hypermotility of the intestinal tract, and they are, therefore, supposed to be due to some pernicious nervous influence.

The treatment necessarily varies with the etiology, and it is therefore necessary to study each case carefully, and particularly to make a careful analysis of the feces. Beginning with the stomach, any disturbance in the gastric secretion should be corrected. The intestinal excretions should be studied to see whether the proteids, starches, or the fats are not properly digested. If any definite results are obtained, then the offensive element in the diet should be reduced to a minimum. As far as possible the pancreatic function should be tested, and if found deficient, attempts should be made to correct it. The bacteriological study of the feces has not been proved of much value in aiding the diagnosis. The microscopic examination, aside from showing undigested muscle fiber and starch granules, or an excess of crystals of fatty acid, may give rise to evidence suggesting the existence of intestinal parasites. These, of course, should be eliminated as promptly and as completely as possible. In those forms with a single focus of inflammation, if this can be removed, the patient promptly recovers, and I have observed some remarkable cases in which the removal of a chronically inflamed appendix produced an immediate cure. Assuming that no definite cause has been found, and that the absence of occult blood from the feces indicates slight if any ulceration, the question arises, What form of general treatment may be employed with the expectation of the most satisfactory results? The methods are regulation of the diet and the use of astringents, possibly combined occasionally with the use of laxatives.

Two diametrically antithetical types of diet have been recommended: (1) A bland, easily assimilable diet, with the design of permitting as little debris to remain in the intestinal canal as possible and avoiding as far as possible fermentation. Such a diet consists of milk, eggs, and the lighter meats, rice, a well-baked potato, macaroni, twice-cooked bread; the avoidance of the coarser vegetables, heavier meats, highly seasoned foods and salads, and excess of sugar. (2) The other diet has been advocated by von Noorden, and gives excellent results. The object is to have as much indigestible material in the intestines as possible, so that the movements will be bulky and the walls of the intestines thoroughly scoured. (See Mucous Enteritis.) It contains the coarser vegetables, such as celery, spinach, etc. In either case the diet must be of high caloric value, from 2000 to 4000 in twenty-four hours. Of the astringents that may be employed, pretty nearly everything that has or is supposed to have astringent qualities has been recommended; but the most efficient are undoubtedly either the tannates or the gallates, and I have reached the conclusion that bismuth subgallate is the most satisfactory preparation for general use. Tannigen and bismuth salicylate are also of value, and the sulphocarbolate of zinc may be rather carefully employed. Any of these astringents may be combined with the antiseptics, particularly guaiacol,

beta-naphthol, thymol, and salol. I am not greatly impressed with their efficiency in these conditions, but at least they do no harm. Of great importance is the improvement in the general hygienic life of the patient. He should be given an adequate amount of rest, as much fresh air as possible, perhaps a change of climate, and, if improvement should take place, gradually increasing physical exercise so that the general condition becomes as satisfactory as possible. In certain cases it will be necessary to resort to opium in order to control the movements of the bowel. Of this the best preparation in these cases is probably codeine. It may be given in doses of $\frac{1}{12}$ to $\frac{1}{8}$ grain once or twice a day, combined with some astringent. There is the greatest danger of the formation of the opium habit, and as little should be employed as is possible.

CONSTIPATION.

This is, of course, merely a clinical symptom, and yet it rises almost to the dignity of an independent disease in the practice of medicine. As a symptom it is the expression of a great variety of conditions having as their bases an even greater variety of causative factors. Naturally, as in all other conditions, the elimination of the cause is the most important element in the treatment. Unfortunately, in a considerable majority of our patients, no cause is discoverable, or, even if discovered, it cannot be removed. It may be said that we should not undertake the treatment of this symptom until a most thorough study of the patient has been made, but unfortunately such a thorough study is not always possible. Roughly we may divide constipation into (1) mechanical, (2) motor, (3) secretory, (4) a rather unsatisfactory group which may be described as habitual or due to the defects in personal hygiene, and (5) a still more unsatisfactory group secondary to various other conditions, such as disturbance of the blood, general infections, etc.

The mechanical forms of constipation are those due to displacement of the intestines or stenosis of some part of the gastro-intestinal tract. In splanchnoptosis the transverse colon is nearly always festooned, giving rise to sharp kinks at the hepatic and splenic flexures. There may also be redundancy and sharp angulations of the sigmoid flexure, and it is supposed that at these points there is obstruction of the onward movement of the colonic contents, giving rise to constipation. Often this constipation alternates with attacks of diarrhea. The treatment is most unsatisfactory. As in all forms of chronic constipation, it has been my experience that physicians try one laxative after another upon the patient until one is found that gives reasonably satisfactory results.

Theories regarding the predominant action of certain drugs upon the small or large intestines appear to have little justification in practical clinical medicine. Of the laxatives that have been employed, cascara, rhubarb, senna, and aloes are the most popular of the vegetable group, sulphate of magnesium, Rochelle salt, and the phosphate of soda the most popular of the saline group, and phenolphthalein the most popular of the

chemical laxatives. The action and administration of these will be discussed under the head of habitual constipation. In these forms daily enemas are also of value, the lower bowel being flushed every morning, preferably at the same time. I have also tried agar-agar in this form and put the patients upon a diet with much debris, without, in the majority of cases, any satisfactory results. Spontaneous recovery not infrequently occurs, and one of my patients, with a marked splachnoptosis and with no other discoverable cause for his constipation, was permanently cured by an attack of ptomaine poisoning, with violent vomiting and purging.

Operative interference has also been advocated, and ranges from the Coffey operation—that is, the formation of an artificial adhesion between the gastrocolic omentum and the wall of the abdomen, so that the transverse colon has a double instead of a single festoon—to the resection of portions of the colon or even, according to the most modern suggestion (Arbuthnot-Lane), the extirpation of the entire colon. In one of my cases resection of the sigmoid flexure combined with the Coffey operation relieved a condition in a child of four years that threatened to terminate fatally. In another a similar operation upon an adult was entirely without results. In several cases of gastropstosis upon which the Coffey operation was performed in association with some operation upon the stomach, a good deal of relief was experienced.

Regarding the extirpation of the entire colon I have no knowledge excepting the enthusiastic reports of its chief advocate.

Intestinal obstruction due to some organic cause is taken up in another section of this work. In the acute forms the treatment of Basch may be employed if for any reason an operation cannot be performed. This consists of the hypodermic injection of large doses of atropine sulphate, from $\frac{1}{50}$ to $\frac{1}{25}$ grain. A single large dose is decidedly preferable to several small doses. The toxic effects are not severe, and sometimes, for some reason that is not clear to me, do not occur. Several times this treatment appears to have been beneficial, always in cases, of course, in which an actual obliterative mechanical impediment did not exist. Atropine, belladonna, and olive oil are most useful in those cases in which operation cannot be performed or must for any reason be delayed. In one such case under my care, for several weeks evacuation of the bowel was secured, and the patient remained moderately comfortable, although at the operation, ultimately performed, it was found that the intestinal lumen was so reduced at the stricture that a fine probe passed through with some difficulty.

Two varieties of *motor constipation* have been described: (1) That type associated with lack of power in the intestinal muscles, and (2) so-called spastic constipation, in which muscular spasms form a mechanical obstacle. Personally, my knowledge of spastic constipation is gathered rather from the literature than from any personal experience, but that its existence is widely believed is evidenced by the constant use of some preparation of belladonna in nearly all the varieties of ready-made laxative pills. As these also contain strychnine, however, it would seem that

their compounders are rather confused in arranging the formulas. The treatment of constipation due to motor insufficiency of the intestines, and it must be premised that the actual demonstration of motor insufficiency is lacking, attempts to achieve results in a variety of ways: (1) By improving the general nutrition of the patient; (2) by developing the abdominal muscles; (3) by the formation of habit; (4) by variation in the diet; (5) by the administration of laxative drugs.

The general improvement in the health is to be accomplished in this condition as in others. Life in the open air, exercise, an ample diet, and, if ever possible, a serene mind. The strengthening of the abdominal muscles will occur in any form of general muscular development, and certain exercises, described in connection with gastropnoia, may also be employed for this purpose. Massage of the abdomen is also of value, and may be performed either by a masseur or by rolling a moderately heavy weight over the abdomen for from ten to fifteen minutes every day.

The formation of habit will be discussed under habitual constipation. The diet should consist of food as bulky as possible. It should contain an abundance of the coarser vegetables and particularly, unless hyperchlorhydria be present, an abundance of fruit, such as figs, prunes, and raisins. The latter seems to be of a good deal of advantage, and should be eaten at least once a day. The coarse meats, and particularly those rich in fat, such as pork and bacon, are desirable. Fatty foods should also be taken liberally. Overeating, however, should not be permitted, the meals restricted to three a day, and not more than enough to satisfy the appetite and maintain the nutrition. Of the laxative remedies, the one that apparently should be the most successful upon theoretical grounds is agar-agar. This is not digestible, but forms a considerable bulk in the intestines that stimulates peristalsis very actively. From one to two ounces should be taken every morning, and it may be eaten with sugar and cream as a cereal. There appears to be no danger of an overdose, and for a time at least this remedy is usually effective; but, because it overstimulates or for some other cause, in my hands it has usually lost its effect in the course of a few weeks or a few months.

Phenolphthalein, on account of the fact that apparently it is excreted solely by the small intestines, and, therefore, probably stimulates only this portion of the bowel, should be of advantage in atonic constipation. The doses vary greatly for different individuals, and probably also for different preparations, although phenolphthalein is supposed to be a definite chemical. At any rate, from $\frac{1}{4}$ to 5 grains, once or twice a day, seems to be the limit of variation. It should be taken in tablet or capsule form, and may even be given hypodermically, although its use in this way has hitherto been experimental only.

The general hygienic treatment is simply the improvement of the patient's condition. For this purpose I have found outdoor exercise the best, and the methods already described in other conditions seem to suffice very well. As a general exercise horseback-riding is probably the best. Long tramps, especially in mountainous regions, may be of benefit, and a few patients do well while camping.

Treatment of constipation due to secretory derangement is in a very unsatisfactory state. Mention has already been made of the form that occurs so frequently in hyperchlorhydria. It frequently disappears if the excessive secretion of acid is controlled. Our methods of diagnosing chronic pancreatitis are not entirely satisfactory, but there is some reason to believe that the administration of pancreatin or pancreatic substance in glutoid capsules or salol-coated pills may be of advantage. There is no method, so far as I know, to diagnose the functional activity of the intestinal glands, and although there is some reason to believe that they may play an important part, there is no means at present available for increasing or diminishing their secretory activity. An excessive secretion of mucus, which is a manifestation of catarrh, may be suggestive, but this form is usually associated with diarrhea.

Habitual constipation, a title used for lack of anything better, can be applied to that form which occurs so commonly in persons who are otherwise apparently in good health. The number of routine treatments that have been devised for this condition is almost infinite, and none of them have been sufficiently successful to have been generally adopted by the profession at large. Massage, exercises, diet, even psychotherapy have been invoked, but all fail in the majority of cases in which they are undertaken. In nearly all cases there is a final resort to laxatives, and there is no evidence that their use, even continued for many years, is at all harmful. Certain habits should, however, be formed; particularly is it desirable to provide for an uninterrupted regular period each day, at which an attempt to procure an evacuation can be made. There seems to be some reason to suppose that this period naturally occurs for most persons in the morning after breakfast, and, if possible, the patient should try every morning at the same hour to retire to the toilet. It has been urged by the psychotherapists that the attention should be fixed upon this period, that the patient should expect a successful result, and not permit any distraction during this time. Even hypnotism has been tried in order that the mental attitude shall be favorable. Although the formation of the habit is eminently desirable, I have not personally found that mental suggestion is of great value. The diet, as has already been stated, should consist of fruits, coarse vegetables, with a moderate reduction in the amount of proteids. Dried fruits should preferably be taken in the evening, and fresh fruits, especially oranges, grapefruit, etc., in the morning before breakfast. Food with considerable residue, such as oatmeal and preparations of bran, may also be taken with advantage. The fats also, as a rule, are laxative, and such fatty foods as butter, bacon, and particularly olive oil should be advocated. The habitual use of 1 or 2 drams of pure olive oil, after each meal, has an exceedingly favorable effect. It must be remembered, however, that in stout persons it is apt to cause an increase in weight. Of the simpler measures, some persons find that $\frac{1}{2}$ dram of sodium chloride taken in a glass of hot water upon arising is adequate. This remedy may be continued for many years without any apparently injurious effect. Even a glass of hot water in the morning is satisfactory in many cases, although its effect is rather psychic

than anything else. Of the laxatives, mercury is the least adapted to habitual use, although cases are recorded in which a pill of blue mass has been taken at night for long periods without salivation, and with apparently good results.

As habitual laxatives, senna in the form of compound licorice powder, 20 to 60 grains, at bedtime; extract of rhubarb, usually combined with soda, from 1 to 3 grains after each meal; cascara in adequate doses, either after meals or at bedtime, seem to be the most satisfactory. Aloes, podophyllin, and colocynth are also occasionally useful, and a pill of aloin, strychnine, and belladonna has been much used. Of the saline laxatives, magnesium sulphate given in hot concentrated solution, just before breakfast, has served well. The dose can, as a rule, be steadily decreased until finally a mere pinch of the salt in less than a teaspoonful of hot water taken every morning suffices. Phosphate of soda is also useful, and even a Seidlitz powder may be taken habitually without particular harm. In the acid cases, oxide of magnesium has proved of great value, and a teaspoonful at night, or smaller doses after each meal, may be employed. Phenolphthalein and agar-agar have already been mentioned.

In cases in which habitual laxatives are required in elderly women, I have had the best results by changing the laxative from time to time, using a vegetable laxative one month and a saline laxative the next. It is far better, in my experience, to use the laxative every day than to use large doses less frequently, the object being to use a little bit less of the laxative each day and thus stimulate the bowel as far as possible to independent activity. It is also important to encourage the patient to reduce the dose. The usual tendency in such cases is continually to increase the dose and to feel dissatisfied unless there has been a purgative result. If this is permitted, I believe, almost uniformly, it will be disastrous. There appears to be a considerable difference in practice in Europe and America regarding the use of enemas. In Europe the habitual employment appears to be exceedingly common. In America, as a rule, they are used only for brief periods. There is no doubt that the patient comes to depend upon them very readily, and is unwilling to do without them, or, if obliged to do so, feels exceedingly uncomfortable; but I must confess that I have never seen any particular injury follow their daily employment, even if used for months or even years.

Kussmaul's method of treating constipation has endured a number of years, and in a certain proportion of cases still proves successful. It is particularly available in those forms of constipation in which from time to time scybalous masses are discharged. It consists of the daily use of an enema of from 8 to 16 ounces of either olive oil or cottonseed oil. This should be warmed and introduced slowly through a small catheter, and retained as long as possible. As a general rule the introduction should be made as follows: The patient should lie upon the left side with the hips elevated upon one or two cushions. The oil is then allowed to flow in slowly for a period lasting from ten to thirty minutes. After it has all been introduced the patient remains in the same position for

five minutes, and then rolls over upon his back with the hips still elevated. This position must be maintained for about fifteen minutes, then the cushions are removed and the patient lies on the right side for a similar period. He may then get up. As a general rule, he should restrict his activity until the enema has been discharged either with or without fecal contents. Very often some time after the enema has been discharged a movement of the bowel takes place, the feces being distinctly softer than usual. The enema should at first be repeated every day, then for a period every other day, and finally at longer intervals, as spontaneous movements of the bowels occur, until it is discontinued altogether. Although I have treated several cases by this method, I have not yet succeeded in achieving a permanent cure, and nearly all the patients have returned to the habitual use of a laxative, although for a time there was a distinct improvement in their condition.

Suppositories and clysters may often be employed. Of the former, gluten suppositories are the mildest, and are often adequate. They may be used daily without harm. Glycerin suppositories are distinctly more efficient and in the majority of cases equally harmless, although sometimes they produce a moderate amount of discomfort and irritation. Home-made suppositories of some bland soap are often employed for children, and may also be useful for adults, but I am not familiar with any instance of their habitual employment. Clysters usually contain either soap or glycerin, or both. In febrile conditions, and especially in typhoid fever, I have found a clyster as effective as an enema, and it has seemed to me less dangerous. A formula that I have found very efficient is 1 ounce of glycerin and 2 drams of magnesium sulphate in 4 ounces of strong soap solution, either castile or ivory soap being employed. Even clysters of pure glycerin in from two to four ounces have been used, and although, as a rule, they cause pain, some patients seem to prefer them; one patient suffering from a gastric carcinoma, with the most obstinate form of constipation, found that an injection of pure glycerin every day was the only thing that served to give him relief. Of the external remedies, such as spraying the abdomen with ether, dashing cold water on the abdomen, etc., it is to be presumed that their effect is rather psychic than direct. It must not be forgotten that occasionally a sudden and spontaneous recovery may occur, particularly in young girls, which unfortunately is often incorrectly ascribed to the treatment, not only by the patient, but also by the physician.

In constipation secondary to general conditions measures designed to relieve those conditions are often of value in assisting the action of the laxative. Thus, in the anemic states, iron and arsenic should be given; in the chronic passive congestion of the intestinal tract that occurs in cirrhosis of the liver, and in some forms of cardiac disease, daily purgation may be of actual benefit; and if in heart disease it is combined with remedies designed to restore compensation, the patient may be considerably improved. In both of these conditions a concentrated solution of magnesium sulphate appears to give satisfactory results. Treatment of constipation with natural laxative waters,

such as Hunyadi Janos, Pluto water, Carlsbad waters, etc., offers no advantage over treatment with ordinary salines, unless they are undertaken at some health resort, but a sojourn at Carlsbad is often of great benefit in these cases. In the obese the association of some measures to reduce the excessive weight also contributes to cure the constipation, and in myxedema the administration of thyroid benefits not only the general condition, but also the sluggish condition of the bowels. Of the more formal hydrotherapeutic measures Baruch recommends the hip bath of from 60° to 58° F., once or twice a day, combined with an abdominal compress, 50° F., at bedtime. In addition he recommends the jet douche of 30 pounds' pressure, with an eighth of an inch nozzle slowly spraying over the region of the colon, the water to be either 45° or 110° F. He also recommends a thorough intestinal irrigation daily, with salt solution, followed by the rapid introduction and outflow of 8 ounces of water at 40° F. These measures, of course, can only be carried out in a well-equipped hydrotherapeutic institute.

Membranous catarrh of the intestinal colon is a rather indefinite condition, characterized by attacks of intense pain and prostration, accompanied or terminating in copious discharges of mucus from the bowel. In the intervals the patient usually suffers from constipation, although there may be a chronic diarrhea. Various methods of treatment have been employed, and in former times it was considered necessary to protect the wall of the intestine as much as possible from any form of irritation, and therefore a bland diet yielding little residue was employed. During the attack various measures have been advocated, but, as a rule, if the pain is severe nothing suffices to relieve it excepting morphine. Von Noorden has advocated a method of treatment which in his hands has given admirable results, and has been used by others with like success. The underlying principle of this treatment is that the basis of the disease is constipation, and that hardened masses of feces constitute the chief irritant to the intestinal mucosa, possibly associated with certain other morbid conditions. Therefore, during the attack, he advocates, first, rest in bed with hot applications. If these fail to relieve the pain, morphine is administered or a suppository containing opium and belladonna inserted. The bowel is also washed, and then an injection given of about half a pint or more of oil, which should be retained as long as possible. This usually gives rise, after a time, to an evacuation of soft fecal masses mixed with oil and mucus. During the interval von Noorden strongly advocates a coarse diet, with the idea of relieving the constipation. This is essentially the diet already recommended for this purpose, but it may be useful to quote a type that he recommends, although he urges individualization in every case:

7 A.M. Ten ounces of milk and cream mixed, consisting of 2 parts milk and 1 part cream.

8 A.M. Half-pint of some sodium chloride natural water.

9 A.M. Ten ounces of milk and cream mixture, sometimes flavored with coffee, tea, or cocoa, and 2 ounces of coarse bread, with 1 ounce or 1½ ounces of butter.

11 A.M. A vegetable soup, graham bread, and plenty of butter.

1 P.M. A meat, vegetables, fruit with coarse skins and large seeds.

4 P.M. Ten ounces of milk and cream mixture, with the coarse bread and butter.

7 P.M. A supper similar to the dinner.

9 P.M. Ten ounces of the milk and cream mixture.

This diet would require considerable modification to accord with American customs of eating, but will furnish a satisfactory pattern from which an acceptable diet can be constructed.

Von Noorden also advocates very highly massage of the abdomen, and in the early days of the treatment the oil enema. He regards the patients as cured whenever the stools are normal in appearance and consistency, and occur daily without the aid of a laxative.

TYMPANITES.

This is a condition due to paralysis or exhaustion of the muscular coat of the bowel, and the result either of obstruction, of a diffuse inflammatory process, or of profound general exhaustion. The treatment, of course, should be directed to the control of the cause; but there are certain general measures that can be employed that seem to be of value. The simplest treatment consists of hot applications to the wall of the abdomen, and of all forms of these, the turpentine stupe is the most efficient. The application may be continued for an hour, changing the stupes at intervals of five or ten minutes. The introduction of the rectal tube is also occasionally followed by the passage of a large amount of gas and great relief for the patient. This, however, only happens occasionally, probably due to the fact that the gas in the intestines is loculated by a series of kinks, as can be readily seen at autopsy. The rectal tube should be well oiled and inserted for a distance of eight or nine inches, and care taken to see that it does not double upon itself. It should be left in situ for hours at a time. Lavage of the colon, especially if a small amount of turpentine is added to a soap and water mixture, is often valuable. As the water is expelled a considerable amount of gas comes with it, and the abdomen becomes softer. In postoperative cases the administration of a laxative often suffices. The moment the peristalsis is reëstablished the patient feels better, even before the evacuation of the bowel has occurred. In the most severe cases the treatment suggested by the late Dr. Frederick A. Packard may be employed. This consists of the hypodermic administration of eserine sulphate. As small doses, even if repeated, apparently have no effect, it is necessary to push the drug in the beginning to the physiological limit. The initial dose should be at least $\frac{1}{50}$ grain, and preferably $\frac{1}{25}$ grain. Under these circumstances the peristaltic action of the intestines may be suddenly restored, there is a copious discharge of flatus, and the patient is promptly relieved. The attempt to relieve the gaseous accumulation by puncture of the wall of the abdomen has sometimes been made, but cannot be commended.

DILATATION OF THE COLON.

Aside from the form that occurs in association with obstruction, the most important is the congenital dilatation known as *Hirschsprung's disease*. The colon becomes a receptacle for feces, many pounds of which may be retained. Apparently the only treatment is the Kussmaul treatment for constipation—that is, the daily use of the oil enema, which is to be retained as long as possible. Gersuny strongly advocates this measure. The question of operation in these cases must be considered, particularly the modern operation of removal in toto of the colon, or short circuiting by a colocolostomy.

HEMORRHOIDS.

The medical treatment of hemorrhoids is of considerable importance, because in the milder cases as long as they remain latent there is no reason for surgical intervention, and often a slight attack may be relieved by some local application. Care should be taken that constipation does not occur. If the hemorrhoids become congested and appear externally, they may, in some cases, be reduced by applications of ice, by a cold bath, or by the use of some simple ointment, such as ichthyol or gallic acid, or belladonna. Suppositories of opium and belladonna may also be employed. If there is much pain a local application of a weak solution of eucaine or cocaine may be applied. Ichthyol and iodoform may also be used in suppositories. A variety of substances have been suggested which may be injected into the hemorrhoids, bringing about coagulation of the blood and the gradual obliteration of the vein. All these measures involve a certain amount of danger, and are at best of doubtful value. Thorough stretching of the sphincter under nitrous oxide anesthesia is a simple and efficient remedy. Boas advises a modification of Bier's passive hyperemia.

ACUTE PROCTITIS.

Acute proctitis is a rather rare condition, usually due to infection as a result of some mechanical interference, and characterized by pain, spasm, and a mucopurulent discharge. Ordinarily it yields to lavage of the rectum with a solution of some mild antiseptic, such as potassium chlorate or boric acid. Ice suppositories also give relief. If the pain is severe a suppository of belladonna and opium may be required.

DISEASES OF THE LIVER, GALL-BLADDER, AND PANCREAS FROM THE MEDICAL STANDPOINT

BY HERBERT C. MOFFITT, M.D.

DISEASES OF THE LIVER

IN harmony with its size and manifold anatomical relations, the functions of the liver are of the greatest importance in the bodily economy. We know that the production of bile is wholly limited to the liver, but it is probable that all the hepatic cells play an equal part in performance of all the complex functions. The conversion of glucose into glycogen and the storage of glycogen are of vital clinical interest; and the dissipation of the hepatic stores of glycogen during fever and in obstructive jaundice has direct bearing on dietary treatment. The regulation and control of certain functions of the hepatic cells was demonstrated by the famous *pique* of Claude Bernard. Glycosuria, as might be expected, has been observed not infrequently in diseases of the liver, but alimentary glycosuria may be due to such varied causes that it is of little value as a measure of hepatic insufficiency. From the experiments of Sachs, and the clinical results of Strauss, Lépine, and others of the French school, it would seem that alimentary levulosuria may give less equivocal evidence of functional disturbance.

The liver cells carry on many of the processes of nitrogenous metabolism, of which the synthesis of urea from ammonia compounds and carbonic acid is the most important. In extensive involvement of liver cells, as in cirrhosis, acute yellow atrophy, or fatty degeneration, urea may be much diminished and ammonia increased, but this results not so much from the loss of power of the cells to form urea from ammonia compounds as from increased acidosis. As pointed out by Münzer, sodium bicarbonate may be of decided value therapeutically in combating the acidosis.

It is now well recognized that the liver has little to do with the formation of uric acid. Leucin and tyrosin may be found in the liver and in the urine in extensive degenerations, as in acute yellow atrophy and in chloroform-poisoning, but they probably result from destruction of the liver cells rather than from deficient oxidation.

Fat is stored in the liver normally, and may be tremendously increased in obesity and alcoholism. Disturbed fat metabolism may occur in destructive liver diseases, and acidosis is added to other toxic manifestations of hepatic insufficiency.

The antitoxic function of the liver is of the utmost importance clinically and therapeutically. It has long been known that certain poisons, as curare, nicotine, strychnine, and morphine, lose considerable of their toxicity while passing through the liver. Metallic poisons, such as lead, mercury, and arsenic, are in part oxidized or held in the liver in organic combinations with the cells. The bearing of these facts upon the administration of drugs by mouth or by intravenous or subcutaneous injection is obvious. The liver cells likewise guard against the entrance of poisons generated in the intestinal tract into the general circulation, and through processes of oxidation and synthesis aromatic bodies like phenol and indol are changed and bound in harmless combinations. In many instances this power of the liver cells becomes impaired, or the toxic products are more abundant and virulent, and irritative or depressive nervous symptoms are manifested. Since the putrefactive decomposition of meat proteids leads to increase in the aromatic group of poisons, it is wise to replace meat by other proteids when hepatic insufficiency is suspected. Specific bacterial toxins, as pointed out by Herter, are distinctly influenced by the action of the liver cells, and bacteria are eliminated in great numbers in the bile.

Through the agency of the liver cells, hemoglobin from broken down red corpuscles is transformed into bilirubin, and in excessive blood destruction much iron is deposited in the liver. Recent researches seem to establish a relation between hepatic activity and fibrin ferment and the coagulating power of the blood, but no definite therapeutic deductions can be made from available data.

Although often difficult to correlate disturbances of hepatic function with definite clinical symptoms, certain hints as to treatment may be drawn from the facts just given. Excess of proteids in the diet frequently leads to increased putrefaction in the intestines and to increased demands on the toxic destroying powers of the liver. Nitrogenous excess still further taxes the liver in the increased urea production. Herter emphasizes the advantages of milk rather than meat proteid, as casein yields fewer putrefactive products in intestinal digestion and smaller amounts of ammonium. Fats are poorly utilized in obstructive jaundice and should be given only in small quantity. They require energetic oxidation processes for their combustion, and should be limited in cases of chronic hepatic insufficiency, as in cirrhosis and fatty liver. We not infrequently see children and adults who cannot take sugar in any quantity without experiencing distress in the liver region and acid indigestion, but, as a rule, carbohydrates are well borne in hepatic diseases and may be freely given.

General Therapeutic Considerations.—Although, as has just been seen, physiology is slowly widening the way to a better understanding of the functions of the liver, clinical observation must still be the chief guide in the recognition and treatment of its diseases. Many of our remedies must still be used empirically, but whenever possible the aim of all therapy should be, here as elsewhere, the proper regulation of the causal factors rather than the mere treatment of symptoms. We

are realizing more and more that many hepatic disorders are of infectious origin. If we could control typhoid, many cases of cholecystitis and cholelithiasis would not occur, and with urotropin properly used during typhoid we perhaps can lessen the incidence of gall-bladder infection. Vaccines and protective inoculation may play more of a role in influencing infection with the typhoid bacillus and the colon bacillus in future. Chronic infections of tonsillar, appendical, or pelvic origin are, in my experience, frequently the cause of symptoms of hepatic insufficiency. In amœbiasis and malaria, tuberculosis, and, above all, syphilis, early recognition and proper treatment may prevent serious liver treatment.

Gastro-intestinal infections may at least be partially controlled by a suitable dietary, by the proper care of enteroptosis and constipation, occasionally by lactobacillin preparations. We have the power in many cases to regulate habits in regard to alcohol and tobacco. It is not advisable to give alcohol as a tonic in recovery from infectious diseases such as typhoid, diphtheria, scarlet fever, etc., in which cell degeneration and necrosis are not uncommon. Probably the least harmful alcoholic beverages are diluted whisky and a light Moselle wine. Much more care should be given to the preparation of patients for operation and to the method of anesthesia. Chloroform should not be allowed as an anesthetic. Chloral and acetanilid are drugs best avoided. Arsenic should be used with caution in cirrhosis.

No general rules of diet can be formulated for the treatment of liver diseases, any more than a routine diet can be made to serve every patient with chronic nephritis. Most Americans eat too much meat, and we rarely err in cutting down the amount of nitrogenous food. Milk may be given to all but a few persons. The present day rediscovery of buttermilk is an excellent thing for the patient with liver disease or insufficiency. Cream and rich milk are less valuable than skimmed milk; milk and Vichy, buttermilk, milk soups, junket, whey, and milk flavored with a little coffee or cocoa may vary the monotony.

Not a few individuals protest that eggs make them "bilious," and I find it advisable frequently to limit eggs to every other day. White fish and occasionally salmon may be allowed; shrimps, crabs, clams, lobsters, and mussels should be forbidden. Many patients cannot take sugar in any quantity, and in acid fermentative dyspepsia all carbohydrates must be limited for a time. Raw fruits and vegetables frequently disagree, whereas cooked green vegetables, cooked fruit, and fruit juices are nearly always to be recommended.

Coffee, save in small amount, is undoubtedly harmful to the individual with disturbed liver function. It seems to disagree more often when taken with cream or sugar than when taken black. Chocolate, cocoa, and tea may be used in moderation. Curries, spices, and condiments must be interdicted. The drinking of water between meals, and of hot water before breakfast, should be encouraged. Waters with small amounts of sodium sulphate, such as Carlsbad, or of sodium bicarbonate, like Vichy, have long been celebrated in the treatment of liver disorders. There is no question of the efficacy of these and other springs,

where change of scene, freedom from care and anxiety, greater attention to dietary rules, exercise, and faith contribute largely to the water cure.

Exercise is of prime importance for individuals who are inclined to liver torpidity and who habitually overeat and drink. Riding, golf, tennis, hunting and fishing, and cross-country walking are far more valuable than gymnasium work or the daily stroll to the office, which salves the business man's conscience.

Care of the nervous system is essential. Eating when tired or nervous will frequently precipitate an attack of indigestion and "biliousness" in a susceptible person. Proper time for meals, and a proper frame of mind at them, will do more for digestion than drugs. A short rest, a warm bath with a change of clothing before dinner, will often be wiser for the busy man than exercise. There is no more valuable therapeutic lesson for a patient who is losing confidence in his liver and himself than to send him camping to the mountains, and to let him observe how successfully digestion proceeds when nervous energy is properly available.

Much discussion has arisen on the relation of hepatic disease to faulty habits in dress. I do not consider the corset a serious menace to health when it is properly fitted and not worn too tight; and many women with enteroptosis and tilted livers are far better with adequate support of the abdomen. Stout men with pendulous abdomens and a tendency to liver congestion are often relieved of an annoying sense of pressure and dragging in the right hypochondrium by an abdominal belt. Chill must be avoided by patients with hepatic disease, and the knitted woolen bandage, indispensable in the tropics, should constantly be worn.

The present-day tendencies are toward simplification of drug treatment. There is no necessity for the great number of new cholagogues that constantly appear in the market. Mercurials, podophyllum, sodium salicylate, sodium benzoate, sodium bicarbonate, sodium glycocholate, sodium phosphate, ox-gall, rhubarb, colchicum, ipecacuanha, ammonium chloride, turpentine, euonymus, sodium sulphate, olive oil, aloes, colocynth, and iodides are the standard remedies most frequently employed.

BILIOUSNESS

It is difficult to persuade the average man that the liver is not the root of all evil. "Biliousness" is a term given to an indefinite group of symptoms, the chief of which are headache, mental sluggishness and inertia, lassitude, nausea, vomiting, and constipation. The tongue is frequently covered with a thick fur, there is complaint of a bitter taste in the mouth, and slight yellowness of the skin and conjunctivæ may be apparent. Although associated in the popular mind with a "torpid liver," these symptoms are due in large part to gastric and intestinal disturbances. Abnormal fermentation and putrefaction in the intestines leads to undue accumulation of toxic products in the portal blood, and the liver is unable to cope with these successfully and prevent their entrance into the general circulation.

Excesses in eating, in alcohol, or, in susceptible individuals, even

moderate amounts of fat, sugar, ripe cheese, may precipitate an attack. I would call attention to the frequent association in children of these so-called "bilious attacks" with chronic infections of the nasopharynx and with chronic appendicitis. In adults, chronic tonsillar infection, larval appendicitis or gall-bladder disease, in women, chronic infections of pelvic origin, may be the cause of the more chronic forms of "biliousness"—the so-called lithemia of Murchison or *hepatisme* of Glénard. These patients suffer from frequent gastro-intestinal upsets, with constipation, loss of appetite, and nausea. They manifest the toxic and nervous symptoms described above, and frequently are sallow or slightly icteric. The liver may be enlarged and the spleen is occasionally palpable. I have seen several such cases permanently cured by proper surgical treatment. The "bilious attacks" of children may later be unmasked as migraine. In the tonic phenomena of this affection, symptoms of hepatic insufficiency are not infrequent and require appropriate treatment. On the other hand, I have been able in several instances to confirm the observation of Kehr, that typical migraine may be due to the presence of gall-stones and may be cured by their removal.

When a patient complains of the mild symptoms of intoxication noted above, 3 gr. of calomel and sodium bicarbonate should be given at bedtime, and 2 teaspoonfuls of phosphate of soda in a tumbler of hot water next morning. If nausea be a pronounced feature, small divided doses of calomel ($\frac{1}{10}$ gr.) may be given every fifteen minutes for ten doses, and followed in two hours by a tumbler of citrate of magnesia. It is rarely necessary to give drugs to control vomiting; if distressing, an enema of a quart of hot water (110° F.) may move the bowels and give relief. Copious draughts of hot water should be administered, or the stomach may be washed out with hot water to which a little bicarbonate of sodium has been added. In the attacks which follow alcoholic or dietary excesses, an emetic may give prompt relief—apomorphinæ hydrochlorate, gr. $\frac{1}{15}$ hypodermically; or powdered ipecac in 30-gr. dose by mouth. The patient should take no food for a day or two, but water, preferably hot, may be freely given. Then milk, skimmed and diluted with Vichy or carbonated water, may be taken in small amounts. Gradually toast, broths, rice, fruit-juices, and cereals may be added to the diet, and after a few days return is made to the usual regimen. During convalescence, saline laxatives should be given every morning for some days—a dessertspoonful of sodium phosphate or a teaspoonful of Carlsbad salt in a tumbler of hot water. If gastro-intestinal symptoms have been marked, ammonium chloride, 5 gr. in hot water, or a little peppermint-water three times daily for two or three days, seems occasionally of value. Bitter tonics, such as tincture nucis vomicæ, infusum calumbæ, fluidextractum taraxaci, may stimulate appetite and digestion.

In patients with recurrent attacks, the diet must be carefully supervised. It may be necessary to limit milk, eggs, sugar, and fats in some cases, and to allow a moderate amount of meat and fish with abundance of green vegetables, fruit, and carbohydrates in the form of dry bread,

toast, rice, hominy, macaroni, or baked potato. Alcohol and condiments should be forbidden. Pure water should be taken freely between meals, and a tumbler of hot water, with the juice of half a lemon, on arising. Three meals daily should be the rule. No food should be taken when the patient is tired or nervous, as indigestion is almost sure to follow; a rest of half an hour, and a cup of bouillon or hot water should precede the regular meal. It may be necessary to insist upon a change of occupation, or to compromise on occasional vacations and outdoor exercise. Gymnasium or home exercise is much less valuable than horseback, golf, tennis, or cross-country walking.

An occasional mercurial at bedtime is to be recommended. I prefer blue mass to calomel, and prescribe usually a capsule containing:

R.	Mass. hydrarg.....	gr. iiss;
	Ext. hyoscyamin.....	gr. ss;
	Ext. colocynth co.....	gr. iiss.—M.

Two of these capsules to be taken at bedtime. Or the following pill may be given in place of the mercurial:

R.	Res. podophylli.....	gr. $\frac{1}{6}$;
	Ext. nucis vomicæ.....	gr. $\frac{1}{4}$;
	Euonymus.....	gr. iij.—M.

Carlsbad salt or sodium phosphate in hot water may be given several times a year in courses of four or five weeks at a time. The long-continued use of nitrohydrochloric acid, 3 or 4 minims in a wineglass of water after meals, has seemed to me of decided benefit.

JAUNDICE

In the course of very varied liver affections icterus may occur and raise interesting questions of etiology, diagnosis, and treatment. It is now generally recognized that all jaundice is hepatogenous in origin, whether toxic, infectious, or obstructive. In cases of obstructive jaundice with complete absence of bile from the intestines, fats are poorly utilized, and 55 to 78 per cent. may go to waste in the stools instead of the normal 7 to 10 per cent. (Müller). It is rational to limit fat in the dietary of such patients. Bile in the intestines furthers peristalsis and consequently acts as a laxative; in its absence this action should be replaced by mild laxatives, preferably salines. Putrefactive changes of proteids are more liable to occur, and intestinal antiseptics, such as small doses of calomel, corrosive sublimate, or salol, are indicated. Though we have already seen that glycogen disappears from the liver in obstructive jaundice, clinical observation has proved that carbohydrates are well tolerated and may constitute a main part of the diet. During the first days of obstruction, bile acids are still produced and their absorption may account for the lassitude, depression, and headache that are often most severely felt at this time. Later their production ceases or is much diminished. The administration of sodium glycocholate or bile is in this type of jaundice clearly irrational. The symptoms of

intoxication that are more or less manifest throughout the entire course, headache, muscular weakness, depression, or nervous irritability, are due to increased absorption of toxic products from the intestines, or to the inability of the liver to cope with the poisons even in normal amount.

Every effort should be made to control intestinal fermentation and putrefaction by limiting sugars, cellulose, meat proteids, ripe cheese, etc., by laxatives and by the antiseptics mentioned above. Diuresis should be encouraged by the free administration of milk, whey, water, Celestin Vichy, cream of tartar water (a teaspoonful to the pint), or by colon irrigations. The skin should be kept active by hot baths, hot packs, or electric-light baths.

The so-called *catarrhal jaundice* is the type of obstructive jaundice that most commonly calls for medical treatment. Initial gastro-intestinal symptoms may bring the patient to the physician. If severe, these should be treated by absolute rest, abstinence from food, and a purge of calomel and sodium bicarbonate, 3 gr. at bedtime, followed by two tablespoonfuls of the saturated solution of magnesium sulphate next morning. After jaundice is established, and bile has disappeared from the stools, it is no longer wise to purge the patient too freely. The bowels should be kept open by a saline each morning, a dessertspoonful of sodium phosphate, or a teaspoonful of powdered Carlsbad Sprudel in a tumbler of hot water, to be repeated if necessary. Since the obstruction is not always due to plugging with mucus, or to swelling of the mucous membrane, but may be caused by pancreatitis or by lymphoid hyperplasia around the duct in the intestine (Eppinger), there is little prospect that purgation or cholagogues will relieve it.

In ordinary cases few drugs are indicated, and diet is all important. For a few days skimmed milk should alone be given, 4 to 6 oz. every two hours; if necessary it may be diluted with Vichy or lime-water. Then toast, crackers, rice, hominy, cereals, like cornmeal or wheatine, chicken or mutton broth, milk soups, and fruit-juices are allowed. A little later, thoroughly cooked green vegetables, cooked fruit, eggs, white fish, and chicken may be added. Fats, meat, and sugars, except in small quantity, alcohol, and condiments should be interdicted. The patients frequently crave acids, and lemon-juice or grapefruit-juice may be extremely grateful; 3 or 4 drops of nitrohydrochloric acid in a wineglass of water three times daily, or dilute hydrochloric or phosphoric acid may serve the same purpose and aid digestion. Occasionally hyperacidity will be bothersome, and sodium bicarbonate in hot water should take the place of the acids. Calomel, gr. $\frac{1}{16}$, four or five times daily, or salol, gr. 5, four times daily, may serve to control flatulence and intestinal putrefaction. Bismuth subgallate in 10-gr. doses several times daily is also of occasional value.

During convalescence tonics like nux vomica, elixir of iron, quinine, strychnine, and phosphate are indicated. The possibility that obstruction may be due to ascarides should be borne in mind, and if eggs be found in the stools, the oleoresin of aspidium should be given. I would emphasize the well-known fact that any jaundice lasting six or eight

weeks is, in all probability, not catarrhal. The presence of a Virchow gland has more than once determined the malignant pancreatic disease that lay behind a so-called catarrhal jaundice. A careful history will often lead to the recognition of an apparently silent cholelithiasis. In doubtful cases an exploratory incision is to be advised rather than too long delay.

Pruritus.—This is a most distressing symptom of jaundice, does not depend necessarily upon its degree, and may, indeed, precede the development of icterus (Riesman). It cannot, therefore, be wholly dependent upon the presence of bilirubin in the skin, but may be caused by other toxic agents. I have found menthol in alcoholic solution (5 to 10 per cent.) to be the most satisfactory remedy. Saturated aqueous solution of magnesium sulphate or a 3 per cent. solution of carbolic acid are useful preparations. Calcium chloride internally may be tried. Sponging with warm sodium bicarbonate solution (1 oz. to the pint), or with 1 : 10,000 bichloride of mercury is recommended by Musser. Hot baths or sweating in an electric-light cabinet or by administration of pilocarpine ($\frac{1}{8}$ gr. hypodermically) may be tried. Ortner recommends dusting the skin with combinations of salicylic acid and talcum, or with menthol, as in the following:

R. Mentholis,
Zinci oxidi.....āā 5.00 ʒj-gr. xv;
Amyli,
Talc.....āā 30.00 ʒj.—M.
Fiat. pulv.

Sig.—To be powdered on the skin.

He has had most success from bromocoll (the 20 per cent. ointment) and anesthesin. This is combined with lanolin and vaseline in the following prescription:

R. Anæsthesin..... 10 ʒiiss;
Petrolati,
Lanolini.....āā 50 ʒiss.—M.
Fiat ungt.

Sig.—External use.

Hemorrhage.—In long-continued obstructive jaundice, or in acutely toxic or infectious cases, hemorrhages may occur. Coagulation time may be much delayed and operations may be attended with great danger. Mayo Robson has advised giving calcium chloride two or three days before operation. Calcium lactate is preferable to the chloride, as the latter frequently produces nausea. I prescribe it to be dispensed in small vials, each containing 15 gr. The content of a vial is shaken into a glass of water and taken three times daily. I have seen no results from the administration of pancreatic or liver extracts. Fresh serum may be injected, as advocated by Weil. He used fresh human or beef serum, 10 to 20 c.c. intravenously, or 20 to 30 c.c. subcutaneously. Antidiphtheritic or antitetanic serum may be used. In hemorrhages from the mouth or nose, irrigations with 4 per cent. gelatine are of value. In gastric hemorrhages gelatine may be administered, or adrenalin, 20 to

30 drops of the 1 : 1000 solution. Transfusion might be done to tide a desperate case over the operative stage.

Nervous Symptoms.—Fortunately the human organism can withstand the usual intoxications accompanying jaundice for long periods of time, and mild headache, depression, apathy, irritability, are, as a rule, the only symptoms from the nervous system. Grave symptoms, however, delirium, twitching, convulsions, coma, may develop, especially in jaundice of toxic or infectious origin, or with extensive degenerations of the liver, as in acute yellow atrophy or cirrhosis, and may rapidly prove fatal. These symptoms are the product of several different factors of cholemia (the intoxication due largely to bile acids), of the inhibition of the usual destructive power of the liver to poisons absorbed from the alimentary canal, acidosis, and of failure of the liver properly to carry on proteid metabolism. Autolysis of liver cells with liberation of toxic products may also play a role. The clinician meets these grave crises usually as a terminal event in cirrhosis of the liver, or as sequels of operations in which chloroform has been used as an anesthetic. Acute yellow atrophy of the liver or phosphorus-poisoning give the same symptom complex, but are much more rarely encountered. Once the grave nervous symptoms become apparent, the therapist is too often powerless. Occasional recovery has, however, taken place even in face of apparent dissolution, so that every effort should be made to help in the elimination of poisons. The bowels should be purged by saturated magnesium sulphate solution, and then salt solution should be given in frequent small enemata ($\frac{1}{2}$ to 1 pint) or, preferably, continuously by the Murphy method. If vomiting is frequent, as it often is, the stomach should be washed out repeatedly. It is of the utmost importance to have the patient take plenty of water provided the kidneys are not seriously damaged. Sodium bicarbonate should be given in large doses if acidosis is shown by the odor of the patient's breath and examination of the urine; 10 to 30 gm. ($\frac{1}{3}$ to 1 oz.) in twenty-four hours is not excessive.

If water cannot be retained, saline solutions should be injected under the skin of the chest or of the abdomen. I prefer Ringer's solution to normal salt; the formula for this is:

R.	Calcii chloridi.....	.25;
	Potassii chloridi.....	.085;
	Sodii chloridi.....	7.5;
	Aq. dest.....	1000.—M.

One liter in the course of twenty-four hours may be given in this way, as larger amounts may cause dilatation of the right heart and pulmonary oedema. Sweating in the early stages should be encouraged by hot baths, hot packs, and hot drinks. Venesection is a rational procedure in the cases with wild delirium and convulsions. From 8 to 10 oz. of blood may be withdrawn and the same amount of Ringer's solution introduced into the vein through the needle. It is not necessary, as a rule, to cut down upon the vein in order to bleed, as a sharp needle of sufficient caliber can be introduced through the skin if the vessel is properly brought

out by pressure. Transfusion would offer even better prospects, especially in cases with hemorrhagic tendencies. Frequent inhalations of oxygen have seemed to me of benefit in quieting restlessness and delirium. Bromides may be given to control the distressing restlessness, and morphine may have to be administered to quiet the maniacal delirium. Chloral and chloroform should not be used. Stimulants have proved of absolutely no value in my hands. The proper treatment of such conditions lies in their prevention, and here the physician should more often play an active part.

Operations for the relief of chronic jaundice due to cholelithiasis, pancreatitis, or pancreatic tumors should not be too long delayed. On the other hand, operations on patients in whom damage of the liver is suspected should not be undertaken too lightly or without due preparation. These seem trite and self-evident facts, and yet I have seen 14 or 15 cases following chloroform, and 1 case following ether, anesthesia. There is little need for chloroform as an anesthetic. Nitrous oxide and oxygen should be used whenever possible when hepatic insufficiency is suspected. If there is sufficient time, patients should be some days on a diet without meat or fats, and bicarbonate of soda should be given for two or three days, 2 or 3 drams daily. The anesthesia should be as short as possible. Salt solution with calcium chloride 3j should be given by Murphy's method after the operation and free diuresis maintained. Chloral should not be given, and morphine should be avoided if possible.

Even the slightest jaundice occurring during pregnancy or after operation should be viewed with suspicion, and the eliminative treatment sketched above at once begun.¹

CIRCULATORY DISTURBANCES OF THE LIVER

Active hyperemia or "congestion" of the liver is usually occasioned by irritants brought by way of the portal vein. To a certain degree it is a physiological event in the course of digestion, but in individuals of gouty or plethoric habit, in those who habitually overeat, in cases of repeated gastro-intestinal disturbances, increased toxicity of the products of digestion reaching the liver may lead to excessive hyperemia and more permanent engorgement. Excessive use of condiments and spices, abuse of alcohol, and the toxic products of varied infections may act in a similar way. Physicians in the tropics dwell upon the deleterious effects of exposure to cold and the dangers that attend a "chill upon the liver." It is impossible clinically to draw lines of division between congestion of the liver and the actual degenerative or inflammatory changes to which is given the name of *acute hepatitis*. The question is one of degree only, and from the therapeutic viewpoint both affections may be treated together. In acute hepatitis temperature is not unusual, pain in the liver is more intense, toxic symptoms—vomiting, headache, depression, irritability—are more severe. The so-called "tropical liver" is a prototype of this affection, due in part to harmful climatic influences, but

¹ The subject of chloroform liver is well covered by the paper of Bevan and Favill and the article of Wells, *Archives of Internal Medicine*, 1908, vol. i, p. 589.

largely to the sedentary life, overeating, excessive indulgence in alcohol, and to the poisons of malaria and dysentery. Ordinarily an attack of congestion of the liver will last a few days; the symptoms of acute hepatitis may demand treatment for some weeks. The danger lies in repeated exposure to the harmful agents rather than in the individual attack, and to the establishment of permanent degenerative changes, as those of cirrhosis. A due regard of the important etiological factors will direct the appropriate therapy.

Malaria and dysentery must be vigorously treated. I can confirm the value of treatment with *ipecacuanha* in the hepatitis of amebiasis by Manson, Chevers, and as advocated particularly by Leonard Rogers.¹ When enlargement and tenderness, moderate fever and leucocytosis, sweating and perhaps chills, indicate definite involvement of the liver, *ipecac* is given in 30-gr. doses each night until active symptoms have subsided. The administration in 5-gr. keratin- or salol-coated capsules is a great improvement over the older method of giving the powdered drug after a large dose of the tincture of opium or of chloral. No food should be given for two or three hours before or after the *ipecac*. Nausea has not been difficult to control provided the capsules have been properly prepared. The treatment is not debilitating and the dose may be reduced to 15 gr. each night at the end of a week or ten days, but it is important to continue as long as symptoms persist in order to avoid relapses.

In the acute stages of congestion the patient should be kept in bed and for a few days diet should be limited to milk, milk and Vichy, or, if milk cannot be taken, to gruels, albumen-water, fruit-juices, and broths made from mutton or chicken. Hot flaxseed poultices or hot compresses over the hepatic region may relieve local distress and pain. A few dry cups or half a dozen leeches may with advantage precede the hot applications. Salines rather than mercurials should be administered until active purgation is secured; an ounce of saturated solution of magnesium sulphate with 10 drops of aromatic sulphuric acid, a half-tumbler of *Apenta* or *Hunyadi* water with an equal quantity of hot water, and these may be repeated as required. For some days the bowels should be kept loose by sodium phosphate, sodium sulphate, or Carlsbad salts, and in convalescence an occasional dose of calomel, blue mass, rhubarb, and soda is advisable. Depletion by drastic cathartics is not indicated. The application of leeches about the anus will rarely be necessary, and puncture of the liver, as practised by Cantlie, will not recommend itself to the practitioner of judicial mind.

While the patient is in bed, trial may be made of the local applications of nitrohydrochloric acid so warmly recommended by English practitioners in India. Their method of application is thus described by Musser: "Eight ounces of nitrohydrochloric acid are mixed with each gallon of water at 98° F. The solution may be applied as a compress;

¹ Leonard Rogers, *The Prevention of Tropical Abscess of the Liver by the Early Diagnosis and Treatment of the Presuppurative Stage of Amebic Hepatitis*, *Archives of Internal Medicine*, vol. i, p. 508.

a flannel roller about a foot wide and long enough to go twice around the body is saturated in the acidulated water, wrung out thoroughly, and wrapped around the region of the liver. It should be covered with a piece of oiled silk slightly broader than the flannel, and may be worn several days, or until decided irritation of the skin is produced. It should be changed every night. If an acid bath is given, the vessel must be of wood, earthenware, or porcelain."

If nausea and vomiting be distressing, food should be withheld for a day or two, and the irritability quieted by sips of hot water, an occasional powder of sodium bicarbonate, and bismuth subcarbonate, each 5 gr., or drop doses of tincture of iodine or creosote. If gastro-intestinal catarrh is a pronounced feature of the attack, ammonium chloride may be given in 10-gr. doses every two hours, five or six doses daily. Fluid-extract of licorice may be used as a vehicle as in

R. Ammonii chloridi	℥iss	6.;
Fluidextracti glycyrrhizæ	℥ij	60.;
Aqua destillata	ad. ℥iv	120.—M.
Fiat sol.		

Sig.—A tablespoonful every two hours.

Ipecac may be of service in hepatic inflammation of whatever source, and should be administered in keratin capsules as described above.

During convalescence, very gradual return should be made to the normal diet. Milk, broths, cereals, fruits, green vegetables, eggs, white fish, toast, and rice may be allowed. Meat in small amount may be added after complete recovery. In this stage, benefit may follow the use of tonics like nux vomica, calumba, gentian, taraxacum, cinchona, or of nitrohydrochloric acid in combination with a bitter.

To avoid future attacks it may be necessary to remove the patient from bad climatic influences. In coming from the tropics to a cold climate the greatest care must be taken to prevent exposure, as acute attacks may result from insufficient clothing and chilling of exposed parts, or of the liver region. Bad habits must be regulated; smoking should be moderated, alcohol denied. Exercise in the open air is nearly always desirable. If possible, patients who have had repeated attacks should be sent every year or every two years to Carlsbad or to Vichy. As yet the control of patients at watering-places of our own country is entirely insufficient, and results comparable to those attained abroad cannot be expected.

With return to the usual mode of life, abstemious habits in regard to food and alcohol should be inculcated. Nervous excesses must be avoided. A sedentary life must be varied by exercise and proper vacations.

Passive Congestion of the Liver.—The engorged liver of broken cardiac compensation very frequently demands attention. Pain may be relieved by dry cups or leeches, mustard or flaxseed poultices. If there is intense cyanosis, pulmonary and hepatic congestion, venesection with withdrawal of from 8 to 20 oz. of blood may give immediate relief

and bring back the patient from an apparently hopeless condition. If bleeding be impossible on account of prejudice in the patient's home, a dozen leeches may be applied over the liver region and hemorrhage encouraged by poulticing with flaxseed. Depletion through the bowel is an effective way of draining dropsy and of reducing hepatic engorgement; 10 gr. of blue mass with 10 gr. of compound colocynth extract form a good combination; 2 oz. of saturated solution of magnesium sulphate each morning usually give several large watery stools without exhausting the patient. If the salts cause nausea, the addition of 15 drops of aromatic sulphuric acid may be of service, or they may be administered in black coffee. Elaterium in doses of $\frac{1}{8}$ gr. may be given in powder with a little milk-sugar, but it is a drastic cathartic and cannot be continued over many days. Compound jalap powder with a teaspoonful of cream of tartar may be tried in place of magnesium sulphate in the morning.

If ascites be considerable, the abdomen should be tapped in the manner described under the section on Cirrhosis. Digitalis preparations should be begun as soon as the initial purge has taken effect. The physician must be certain of his drug, and must give large enough doses in order to obtain results. The infusion in $\frac{1}{2}$ -oz. doses, or 20 minims of the tincture, may be given every three or four hours for the first two or three days and then decreased. The combination of powdered digitalis with squill and calomel or blue mass, variously known as Addison's or Niemeyer's pill, is a good cardiac stimulant and diuretic. The usual formula calls for a grain each of powdered digitalis leaves and powdered squill, and from $\frac{1}{6}$ to 1 gr. of calomel. Theocin in conjunction with digitalis is often a wonderful diuretic; 15 gr. may be given daily for a few days. The drug may cause nausea and vomiting or, rarely, convulsions; and, since the article of Schlessinger, I usually prescribe 4 or 5 drops of the fluidextract of adonis vernalis to be taken with it. Diuretin, sodiotheobromine salicylate, is a valuable heart stimulant and diuretic, 15 gr. every three or four hours may be given in peppermint- or chloroform-water. A light dry diet is the best one for these patients. Milk or buttermilk may be given in small quantities, but fluids should be limited to a liter daily. Salt should be reduced as far as possible.

It has been my experience that the chronic congested liver of long-standing heart, pulmonary, or cardiorenal disease is frequently misinterpreted clinically. The left lobe may be enlarged disproportionately and be taken for an epigastric tumor. In the presence of an enlarged spleen the diagnosis of chronic passive congestion of the liver should not be made too lightly. The so-called cardiac cirrhosis is a rare disease at the bedside, and the majority of these cases prove to be chronic infectious endocarditis, concretio pericardium, or independent cirrhosis. I have seen chronic hyperemia result from interference with the inferior cava through pressure and torsion caused by tumors. In one instance a large hypernephroma of the right kidney rotated the liver and distorted the vena cava, in another an echinococcus cyst of the liver led to compression of the vein. Operation in the first case led to disappearance of the liver enlargement.

DEGENERATIONS OF THE LIVER

Acute yellow atrophy has been treated in the section on Jaundice. Senile "brown atrophy" is no more interesting therapeutically than clinically. Cloudy swelling is seen clinically most often associated with the infections, and its treatment is that of the original disease.

Fatty Liver.—Fatty liver is a term to be preferred to "*fatty degeneration*," as excessive fat may be stored in the liver without associated degeneration. Fatty changes are found frequently in children, the result of gastro-intestinal disorders, and are not uncommon after anesthesia, especially when chloroform is used. Symptoms of acidosis may result, in part, at least, due to the hepatic insufficiency. Sodium bicarbonate should be administered freely by mouth or rectum, and solutions of glucose may be used in the same way. In obesity the fat deposit is in harmony with the general excess. This form of fatty liver is to be treated by limiting the ingestion of carbohydrates and fats. Eggs, fish, meat, vegetables, and fruit should constitute the dietary, and liquids must be restricted. Treatment of the circulation will frequently be necessary before the patients may be permitted to exercise. Mild saline laxatives, such as the natural aperient waters or sodium sulphate or phosphate, are in order, but excessive purgation is too exhausting. In anemic fat patients a modified Weir Mitchell cure, with massage and iron, may be beneficial. With thyroid insufficiency thyroid extract may be given, but its administration requires caution. Chronic alcoholism is a common cause of fatty liver, and combinations with cirrhosis are frequent. The enlarged greasy liver of tuberculosis is not due, as is still frequently taught, to the excessive amounts of cod-liver oil and other fats ingested during the long course of the pulmonary disease, but to the toxic influence of products of the tubercle bacillus and of associated pyogenic cocci. The treatment is wholly that of the primary disease; alcohol is fortunately much less employed at present in tuberculosis, and should not be given when fatty liver is suspected.

Amyloid Degeneration.—Amyloid degeneration is of much more interest diagnostically than therapeutically. Preventive treatment should be directed to the control of any chronic suppuration. Tuberculous sinuses should be treated surgically or by bismuth pastes. Thorough treatment should destroy the dangers of chronic syphilitic infection.

INFLAMMATIONS OF THE LIVER

Acute hepatitis has been considered with the circulatory disorders of the liver. *Suppurative hepatitis*, or *abscess of the liver*, is seen clinically most often associated with suppuration in the distribution of the portal radicles (in the course of appendicitis, perforating ulcers of the bowel, suppurating hemorrhoids), with suppurative cholangitis, or with dysenteric ulceration of the bowel. The treatment is purely surgical, and I cannot agree with clinicians who advocate exploration with a needle, and who suggest treatment of amebic abscesses by injections of quinine hydrochlorate in solution. In amebic abscesses an exploratory

laparotomy should be done, the abscess located, drained at once if suitably situated, or attacked by the transpleural route with the assured confidence in localization gained by the exploration. It is to be hoped that multiple abscesses of pyemic origin may in future be attacked by means of sera and vaccines.

Chronic interstitial hepatitis, or cirrhosis of the liver, is best classified for convenience of therapeutic consideration into portal and biliary varieties.

Portal Cirrhosis.—This variety has been described under many names—alcoholic, atrophic, Laennec's, multilobular, or portal cirrhosis. Certain facts in etiology are of prime importance in prevention. Abuse of alcohol is the commonest etiological factor, and yet it has been rarely possible to produce experimentally the lesions of cirrhosis by feeding alcohol. Many chronic alcoholics have perfectly good livers on the autopsy table, and we are appreciating more and more that alcohol is productive of cirrhosis indirectly rather than directly through lowering the resistance of the hepatic cells to toxic products brought to them by the portal vein (either from stomach and intestines or from the spleen) or by the hepatic artery (toxic products of infections). The cirrhosis in Mohammedans, who do not take alcohol, has been traced to other hepatic irritants, such as pepper and ginger. The deleterious influences of gastrointestinal indigestion, of abnormal intestinal putrefaction—especially of proteids, of chronic infections of the alimentary tract (tonsillitis and appendicitis), upon the liver have been considered in the sections on Biliousness and Acute Hyperemia. Changes in the liver brought about during typhoid, by chronic tuberculosis, especially of the peritoneal cavity, by the toxins of intestinal parasites, may result in cirrhosis in susceptible patients or in individuals exposed to other liver poisons. Alcohol should not be given so freely during typhoid or in convalescence. We have seen above other reasons to limit it in tuberculosis.

From the study of the microscopical lesions in cirrhosis it is evident that if the etiological factors could be controlled before regenerative processes are exhausted, or extensive degeneration has resulted in extensive formation of connective tissue, the disease might be arrested. Diagnosis in the early stages is of the utmost importance for successful treatment. Recurrent or persistent enlargement of the liver in individuals addicted to alcohol should be regarded with strong suspicion. Repeated gastro-intestinal disturbances accompanied by discomfort or pain in the liver, by slight jaundice, or by urobilinuria, have the same significance. Suspicion becomes strengthened if an unexplained enlargement of the spleen is determined. Discoloration of the skin, the occurrence of spider angiomas, small nevi, or the "mat nevi" described by Osler, may give hint of the developing disorder. Urobilinuria, excess of phenol in the urine (Edsall), alimentary levulosuria, may mark the hepatic insufficiency. Purpura, hemorrhages from the gums, nose, stomach, or bowel are later and so less valuable symptoms, as are the evidences of increasing trouble with the portal circulation as manifested by enlargement of abdominal veins or by increasing size of the spleen.

In these earlier stages every effort should be made to spare the damaged organ. Alcohol and condiments must be absolutely forbidden. Tinctures and kourmyss, which contain alcohol, should not be given. Meat proteid should be largely replaced by milk. Fats should be limited and skimmed milk and buttermilk are better than rich milk. The monotony of milk may be varied by milk soups, junket, milk puddings, and milk gelatine. Fruits and vegetables are beneficial and may be given uncooked unless flatulence is occasioned. Vegetables like spinach, asparagus, green beans, artichokes, green peas, lettuce, tomatoes, are especially desirable, while cabbage, radishes, beets, sprouts, cauliflower, are more apt to cause fermentation and discomfort. Oranges more often occasion acid indigestion than grape-fruit or lemon-juice. Strawberries and rhubarb do not agree with many patients. All fruit should be taken with little sugar. Starches may be allowed freely and, with milk, constitute the main diet. Oatmeal has seemed to me less desirable than cereals made from wheat or corn. Rice, hominy, macaroni, or spaghetti seem to cause less flatulence than potato in patients with a tendency toward intestinal fermentation. Simple puddings, a little gelatine or ice-cream, or cooked fruits may be given for dessert. Eggs and white fish may be permitted occasionally, and rarely a little meat—chicken, lamb, or beef. In my experience boiled meat is less apt to disagree than roast or broiled. Coffee and chocolate should be prohibited, a little tea or cocoa may be allowed. Diet should be regulated by observation of the individual case; if a predominant milk diet weakens the patient it must not blindly be continued. Variety must be afforded from time to time, but injurious foods must always be strictly forbidden. To obtain results, regulation of the diet must continue through years.

Gastro-intestinal indigestion may be helped considerably by drinking hot water freely between meals. A little bicarbonate of sodium or sodium phosphate may be added to each glassful. Celestin Vichy or Carlsbad Mühlbrunnen may be given for periods of three or four weeks several times a year, in the manner described in the section on Cholelithiasis. More active purgation may be advisable if congestive symptoms are pronounced, and may be secured by magnesium sulphate, sodium sulphate, or sodium phosphate given in the morning, or by an occasional dose of calomel or blue mass at bedtime. The pilulæ podophylli, belladonnæ et capsici, two at bedtime; pilulæ rhei compositæ, two or three at bedtime; and pilulæ catharticæ compositæ, two at bedtime, are useful preparations. When catharsis is not desirable, gentler laxative measures may be employed—cascara preparations, a pill of aloes and myrrh, agar with cascara, a teaspoonful of sulphur and cream of tartar. If tonics are indicated, the bitter infusions of calumba, quassia, and gentian will best serve the purpose, in doses of 1 or 2 tablespoonfuls before meals. A pill to be taken before meals may be composed of:

R.	Extracti nucis vomicæ.....	gr. ½	0.03;
	Extracti gentianæ.....	gr. iij	0.02;
	Quininæ sulphatis.....	gr. iss	0.01.—M.

10 to 20 drops of dilute hydrochloric acid, or 4 drops of nitrohydrochloric acid, may be given in a wineglass of water after meals. A number of authors highly recommend ammonium chloride in daily doses of 30 or 40 gr. for relief of gastro-intestinal symptoms and hepatic congestion. If a stomach irritability is persistent, the diet should be limited to peptonized milk, milk and Vichy, or milk and lime-water for some days. The following powder may be given several times daily:

R.	Cerii oxalatis.....	gr. iij	0.2;
	Sodii bicarbonatis.....	gr. v	0.3;
	Bismuthi subnitrat.	gr. v	0.3.—M.
	Et fiat pulv. No. i.		

A drop of tincture of iodine in a teaspoonful of water, or drop doses of creosote may quiet nausea.

For its action in intestinal digestion, Hare suggests a capsule to be taken during meals:

R.	Pancreatin,		
	Taka-diastrase,		
	Sodii bicarb.....	āā gr. ij	.12.—M.
	Fiat caps. No. i.		

Among the many remedies suggested at different times for their action as intestinal antiseptics, the following seem to me most worthy of trial:

1. Bismuth salicylate or bismuth subgallate, 10 gr. (0.6), three or four times daily.

2. Phenylis salicylatis, gr. v (0.3), four times daily.

3. Beta-naphthol in 5-gr. capsules three times daily, or in the following powder recommended by Ortnier:

R.	Beta-naphtholis.....	ʒss	15;
	Bismuthi salicylatis,		
	Sodii bicarbonatis.....	āā ʒij	7.50.—M.
	Fiat pulv. No. i.		
	Div. in. dos. aeq. No. xxx.		

Sig.—A powder after each meal.

4. Calomel in doses of $\frac{1}{20}$ to $\frac{1}{30}$ gr., or bichloride of mercury in doses of $\frac{1}{30}$ gr. several times daily.

Yeast may control intestinal putrefaction in some instances, but it can rarely be given over long periods without discomfort. A tablespoonful of brewer's yeast, or 30 gr. of compressed yeast, may be given before meals. Lactobacillin preparations are often decidedly helpful and may be continued indefinitely. With the idea of influencing pathological processes in the liver, 5 gr. of sodium iodide may be given in hot water two or three times daily. I have seen benefit from long continued use of hydrargyri iodidum flavum $\frac{1}{4}$ to $\frac{1}{2}$ gr. in a pill, or hydrargyrum cum creta, gr. ij in tablet form after meals. No benefit can be expected from the lately recommended injection of fibrolysin.

In plethoric stout individuals active exercise and sweating will be indicated. Careful examination of other organs should always be made,

as special therapy may be necessary. If there be general arteriosclerosis and a dilated heart, Nauheim baths will be more beneficial than exercise; small doses of theobromine or diuretin and sodium iodide may be given. In anemic individuals, iron, preferably in the form of the official *pilulæ ferri carbonatis*, may be administered freely, but arsenic is less desirable on account of its action in favoring fatty degeneration. If a slight trace of albumin in the urine or the presence of a few casts give evidence of slight renal complications, elimination through the skin becomes of greater importance; iron may be given in the form of the official *liquor ferri et ammonii acetatis*, a tablespoonful three times daily.

I regard the treatment of chronic infections due to colon bacilli or to pyogenic organisms as of the greatest importance. Chronic nasal obstruction with pent-up secretion, sinusitis, chronic tonsil infections, pyorrhea alveolaris, must receive appropriate treatment. Chronic acne or furunculosis may be benefited by vaccines. Hemorrhoids rarely give trouble, but if they ulcerate or suppurate operation may be necessary. Chronic cystitis, chronic prostatitis, pelvic inflammations, chronic appendicitis, demand special treatment.

Hemorrhage may occur even in comparatively early stages of the disease from infectious or toxic changes in the gastric mucous membrane, and may be of signal service in calling attention to the latent hepatic disease. Bouchard has called attention to the frequency of nevi in the pharynx, from which bleeding may occur. Profuse epistaxis and bleeding from the bowel have been early symptoms in several of my cases. These early hemorrhages carry a less grave prognosis than the later ones, due to advanced portal obstruction or to terminal toxemia. Care should be taken not to overlook a stomach or duodenal ulcer. Differentiation is not always easy, as in my experience occult blood in the stools may be found frequently in cirrhosis. Abstinence from food for forty-eight hours should be insisted upon after a stomach hemorrhage. Salt solution by rectum will relieve thirst, or the mouth may be rinsed frequently with hot water. Morphine, $\frac{1}{8}$ to $\frac{1}{4}$ gr. hypodermatically, will quiet restlessness and relieve the nervousness often occasioned by the terrifying event. If the initial hemorrhage is large, or if cerebral anemia result from repeated bleeding, a pint of salt solution or Ringer's solution should be injected into an arm vein; and, while the fluid is entering, 5 to 10 minims of adrenalin solution (1 to 1000) may be injected through the rubber tube into the flowing stream in the manner suggested by Crile. If the situation is more desperate, transfusion may be tried if a suitable subject be at hand. Calcium chloride may be given in 60-gr. doses by enema twice daily. Subcutaneous injections of gelatine are painful, and, as a rule, properly sterilized preparations are not available; 40 c.c. of Merck's 10 per cent. solution may be given in desperate cases and repeated in six hours. The injection of 20 to 30 c.c. of fresh rabbit serum, or of antidiphtheritic serum subcutaneously, may be tried in the hemorrhages of stasis as well as from toxic causes. If small amounts of blood are being vomited frequently, 20 drops of adrenalin solution (1 to 1000) in a teaspoonful of water may be administered and repeated once or twice.

I have seen no benefit from styptics, but Rolleston recommends the so-called Ruspini's styptic, "which is largely composed of gallic acid; the styptic may be given in $\frac{1}{2}$ - to 1-dram doses in an ounce of water by the mouth. Two successive $\frac{1}{2}$ -dram doses may be given." The use of ice-bags, or a Leiter's coil, over the abdomen seems to me theoretically bad treatment. It may serve to keep the patient quiet and be of suggestive value. Turpentine in 20-minim doses in capsule, or in an ounce of water with 10 minims of spirits of chloroform, may be given every four hours in cases of stomach and bowel hemorrhages, as recommended by Rolleston and others. Personally, I give no drugs but adrenalin by mouth.

Cautious return to stomach feeding may be made forty-eight hours after hemorrhage has ceased. Peptonized milk, iced milk with lime-water, should first be given, 2 or 4 teaspoonfuls every fifteen minutes. The amount may gradually be increased and the interval between feedings lengthened to an hour or two; within a week the patient may be on gruels, soft eggs, and milk-toast. The occurrence of hematemesis often prepares the patient psychically for a proper appreciation of the rules of living necessary for his future well being.

If epistaxis is excessive, a catheter should be passed through the nose and borated or iodoform gauze brought up to pack the posterior nares. Irrigation by hot gelatine solution (5 per cent.), antipyrine solution (4 per cent.), by solutions of calcium chloride or adrenalin, may be efficacious in the ordinary case. Ruptured veins on the nasal septum may be touched with chromic acid, and nevi of the pharynx may be controlled by application of silver nitrate or the actual cautery. If hematemesis or melena be repeated, and enlargement of the spleen be pronounced, the possibility of splenic anemia or Banti's complex should be considered, and the advisability of splenectomy discussed.

Ascites.—With decided signs of portal obstruction, enlarged abdominal veins or a large splenic tumor, especially with the advent of ascites and peripheral cedema, the outlook in cirrhosis becomes much more gloomy. In this stage not much is to be expected from strict rules of diet, and it may be advisable to feed the patient liberally and even to allow small quantities of alcohol in the form of well diluted whisky with meals. Rest is more indicated than exercise, and cardiac insufficiency may demand treatment with digitalis, theobromine, or diuretin. Heart tonics, and diuretics like calomel, squills, diuretin, cream of tartar, theocin, may control the abdominal transudate for a time. Fluids and salt should be limited in the diet. A number of American clinicians have reported excellent results from the use of apocynum, and these I can in a measure confirm. Five minims of the fluidextract or of the tincture may be given every three or four hours. Excessive administration may cause vomiting and purging. Hare has recommended a fluidextract of asparagus in dram doses three times daily.

The treatment of ascites by drastic purgatives has fortunately been abandoned, as it exhausts the patient and excites gastro-intestinal inflammation. The bowels may be kept mildly opened by salines, senna, or small doses of colocynth or jalap.

A proper appreciation of the different causes of ascites in cirrhosis is necessary for the determination of treatment by tapping or operation. The frequency of tuberculous peritonitis in patients with cirrhosis should be remembered. Usually when this complication is determined, little can be expected from treatment by laparotomy. It is well always to remember the possibility that the symptom complex of cirrhosis may be caused by concretion pericardium with multiple serositis. In a few cases, improvement in the earlier stages of this affection has followed Brauer's operation of "cardiolysis." Tapping may have to be repeated frequently; the Talma operation is not indicated. My experience with ascites in cirrhosis coincides in the main with that of English clinicians, and is well voiced in the following paragraph from Rolleston:

"A distinction has been drawn more especially by Hale White and Campbell Thomson between ascites due to cirrhosis, in which the prognosis is of the gloomiest character, and ascites associated with cirrhosis but due to some other cause, such as chronic peritonitis. In ascites associated with chronic peritonitis tapping may be required frequently, and occasionally recovery may occur, while in ascites due to cirrhosis tapping is seldom required more than once, and is soon followed by death." When ascites develops, therefore, while the general condition of the patient is still good, it is probably due in part to chronic peritonitis, and the question should at once be raised whether it is more advisable to begin tapping or to proceed at once with the Talma-Morison operation. The advisability of operation will have to be considered, even without ascites, in those patients in whom the history—an enlarged liver and spleen, hematemesis, or melena—make it most probable that cirrhosis of the liver is established. For technique and statistics of the operation, see the section on Surgical Treatment. I have seen decided benefit in a few cases and would advocate operating in early cases when there is no jaundice, no evidence of toxemia, and when the condition of the heart and kidneys is good; operation, after cachexia is evident and the above complications are present, is useless and hastens death.

Rolleston thus explains the benefit derived from the procedure: "1. By somewhat diminishing the flow of blood through the liver it may enable that organ to deal more satisfactorily with the blood passing through it, and so reduce the toxemic condition of the blood, which is probably the important factor in inducing ascites. 2. That the presence of vascular adhesions over the surface of the liver would relieve venous engorgement and so allow a freer supply of arterial blood to the liver. The nutrition of the liver cells would thus be improved, and they would be under better conditions to undergo compensatory hyperplasia. The compensatory hypertrophy of the liver will enable the organ to perform more efficiently its important antitoxic functions, and so lead to a latency of the symptoms. If the last hypothesis be true, it is evidently of importance that any operation for the formation of vascular adhesions around the liver should be undertaken before the liver tissue is so disorganized that compensatory hyperplasia is impossible."

If for any of the above reasons operation is contraindicated, tapping should be done to relieve ascites as soon as distention becomes uncomfortable and medical measures have proved ineffectual. Diuretics will often act better after the pressure of ascites has been removed. Other indications for tapping are given by marked edema of the legs, interference with respiration and proper heart action, and the occurrence of stomach or bowel hemorrhages.

Before *tapping*, the bladder should be emptied and the skin of the abdomen prepared by washing with green soap, alcohol, ether, and corrosive sublimate solution 1 to 1000, and painting with tincture of iodine. The patient should be sitting on the side of the bed, and an assistant may support his back and be prepared to exert pressure on the abdomen by a broad or many-tailed bandage. I make it a rule to have a hypodermic syringe ready with morphine, gr. $\frac{1}{4}$, and atropine, gr. $\frac{1}{150}$ in case of cough, pulmonary oedema, or collapse, but rarely need to use it. A little whisky or aromatic spirits of ammonia may be given if faintness be manifested. I prefer to use a small trocar and canula (such as come with the Potain or Dieulafoy aspirator) with a side branch near the head, so that a rubber tube may be attached to this before introduction. After the trocar is withdrawn, the stop-cock at the end of the canula is turned and the fluid siphoned off into a tub beneath the bed. Paracentesis is more easily done in the linea alba, midway between the pubes and umbilicus. The skin may be rendered anesthetic by freezing with a spray of ethyl chloride, or sensitiveness may be reduced by compresses of carbolic acid (5 per cent.), or by holding a mixture of ice and salt in a sterile test-tube against the abdominal wall. I rarely find it necessary to inject Schleich solution and to make a preliminary small incision. The instrument is plunged quickly into the abdomen and the trocar withdrawn. It is important to drain the fluid slowly, and this can be controlled by pressure on the rubber tube. I have seen no advantage from injection of adrenalin (20 to 30 drops of the 1 to 1000 solution in an ounce of normal salt) after the fluid has ceased to flow. When the operation is finished, the canula is quickly withdrawn and a pad of sterile gauze fastened over the opening with adhesive plaster. A firm bandage is applied around the abdomen and the patient put in bed on his back for a few hours, as I prefer to have the opening close without seepage. The bandage should be worn for several days. French clinicians prefer to tap at the point of Plicque, a spot midway on a line from the left anterior superior spine to the umbilicus, in order to avoid any danger of wounding the cecum or liver.

If properly performed, tapping may be repeated occasionally for months and even years without untoward results. The chronic peritonitis sometimes following repeated paracentesis may be of value in developing an extensive collateral circulation and thus controlling ascites. The possibility of the permanent disappearance of ascites and of an arrest of the cirrhosis has been recorded by a number of observers. (See Dieulafoy, Clinique médicale de l'Hotel-Dieu.)

Nervous Symptoms.—These may be partly alcoholic, in part uremic,

and in chief part probably due to hepatic insufficiency. The treatment of grave terminal symptoms has been given in discussing jaundice and acute yellow atrophy; in the terminal toxemia of cirrhosis, it has a hopeless outlook.

Complications.—*Alcoholic neuritis* may require treatment for the relief of pain. I have found compresses of the saturated solution of magnesium sulphate or applications of menthol (5 per cent. alcoholic solution) of greatest service. Strychnine should be given in gelatine-coated pill or, preferably, hypodermically in doses of $\frac{1}{80}$ to $\frac{1}{20}$ gr. three times daily. *Bronchitis* should be treated by tapping, by cardiac tonics, and by ammonium chloride or creosote. In *jaundice* with slight fever, hexamethylenamine may be administered in tablet form, $7\frac{1}{2}$ gr., four times daily. *Effusion* into the right pleura is not uncommon and may require tapping for relief of dyspnea. The pain of *perihepatitis* may be relieved by hot applications. Occasionally attacks of acute pain occur, simulating biliary colic, and these must be treated by poultices and subcutaneous injection of morphine. The possibility of syphilis must be considered in every case of cirrhosis, and if a Wassermann reaction be positive, energetic treatment with mercury and iodide must be instituted. I would warn against vigorous specific treatment unless definite evidence of syphilis is obtained, as it is debilitating, and I have seen patients quickly decline after being subjected to it.

Opothrapy.—This has been most warmly advocated by French clinicians. Mouras collected 14 cases in which improvement followed in 7 after ingestion of pig's liver, or the injection of an extract called *hepatin* subcutaneously. Vidal reported good results from the ingestion of hashed pig's liver, 2 to 3 oz. daily by mouth. More recently, favorable reports have been communicated by Spillmann and Deamnge, Sandouz and Dieulafoy, Regnault and Créquy, and Hirtz. The only unfavorable symptoms noted have been vomiting and diarrhœa. I have tried pig's liver in pulp, 3 or 4 oz. daily by mouth, without any noticeable effect. It has been suggested that the favorable results occasionally noted have been due to the diuretic effect of the urea in the liver or to the diarrhœa occasioned.

Biliary Cirrhosis.—The treatment is chiefly symptomatic, as we are still ignorant of the causal factors. The disease is most probably an infection playing its part chiefly in the smaller bile-ducts and in the spleen. Gastro-intestinal disorders play a less important role than in the portal variety, and diet rules need not be stringent. Alcohol and other hepatic irritants should be avoided. Rolleston suggests that all water be boiled, as infection may enter through drinking water. Parkes Weber first suggested that remedies should be employed which, when eliminated in the bile, would act as antiseptics. Salicylates and hexamethylenamina may be administered with this idea in mind, and apparent benefit has been reported from their employment. A mild Carlsbad cure is occasionally indicated. Drainage of the gall-bladder has been tried in a number of cases, apparently with good results in a few, but it is doubtful whether these were not really cases of cholecystitis and

cholangitis, and not true biliary cirrhosis. The operation cannot be recommended.

SYPHILIS OF THE LIVER

It is a lamentable fact that the only disease of the liver for which we have a satisfactory and specific cure should be so often misinterpreted or overlooked by the physician. It is of frequent occurrence in childhood; and I have often seen children with chronic gastro-intestinal disorders, attacks of so-called "biliousness," periodic vomiting due to acidosis, promptly cured by mercury and chalk, inunctions, or the protiodide of mercury. Now that the Wassermann reaction is at our command, there should be less excuse for long-delayed diagnosis. In adults, liver syphilis may cause painful attacks simulating cholecystitis (Riedel). Perihepatitis may cause persistent pain in the hepatic region, or may give pain referred to the right shoulder. Gummata may simulate tumors. The picture of cirrhosis of the liver may be produced by diffuse syphilitic hepatitis. Remarkable continuous or intermittent fever may occur and be associated with chills and sweating. Pylephlebitis may be the cause of quickly appearing and recurring ascites. The literature of the protean forms of hepatic syphilis is well given in the recent article of Edwards.¹

Naturally, true portal cirrhosis or cancer of the liver may develop in syphilitic subjects, but in all suspicious cases thorough specific treatment should be instituted and not abandoned too quickly. I prefer to administer mercury by inunctions. A dram of unguentum hydrargyrum is rubbed thoroughly into the skin each night, varying the region treated in the customary manner. The patient is given a hot bath before beginning the course, and again every seven days. Six inunctions are given each week and the treatment continued until thirty or forty have been taken. Care of the mouth is most important. A saturated solution of iodide of potassium is administered at first in 10-drop doses, and rapidly increased up to 40 or 60 drops three times daily. The iodides are nearly always well tolerated if given in a full tumbler of water or milk, and surrogates are not necessary. An energetic cure with mercury and iodide is best carried out when the patient is kept at rest. Tonics, as iron and strychnine, may be necessary. Duration of the treatment must depend upon the character of the lesion. Here, as in other syphilitic infections, subsequent treatment must be guided by continued clinical observation and by occasional Wassermann reactions.

The application of Ehrlich's ideal *Therapia sterilisans magna* to the cure of liver syphilis has already been reported by F. Klemperer and others. Good results have been obtained, as in other late manifestations of the disease, from dioxydiamidoarsenobenzol ("606"). Until further reports are available, I would hesitate to use the preparation in liver syphilis through fear of the greater liability of arsenical poisoning when the hepatic cells are already diseased.

¹ American Journal of the Medical Sciences, October, 1910.

HYDATID CYSTS OF THE LIVER

Simple puncture of the cyst has been advocated, and electrolysis or injection of fluids such as alcohol, formalin, and solutions of bichloride of mercury, have been practised. It seems a far more rational procedure, as in hepatic abscess, to have the abdomen explored and the cyst surgically treated.

ACTINOMYCOSIS OF THE LIVER

The prognosis of actinomycosis is made much worse when the disease involves the liver. Iodide of potassium in large doses, as recommended by Thomasson, offers the best prospect of checking invasion. Bevan recommends the administration of cupric sulphate in doses of $\frac{1}{4}$ to 1 gr. three times daily. Recently good results have been reported from the use of vaccines.

MALIGNANT DISEASES OF THE LIVER

The treatment of carcinoma or of sarcoma of the liver is wholly symptomatic, except in the rare instances in which invasion of the organ by gall-bladder carcinoma admits of partial resection by the surgeon. Pain may be relieved by applications of heat locally, or occasionally by x-ray treatment. The following capsule two or three times daily may be tried:

R. Myristicæ.....	gr. j	.06;
Methylthioninæ hydrochloridi.....	gr. iij	.18.—M.
Fiat caps. No. i.		

In view of the hopeless condition, the relief afforded by opium preparations should not be denied.

CHOLANGITIS

Acute catarrhal cholangitis has been described under the heading Jaundice. Chronic catarrhal cholangitis may be marked by paroxysms of chills, fever, and sweats; jaundice occurs in varying degree. Diet in these cases may comprise cereals, broths, fish, a little meat, rice, toast, and simple puddings, as well as milk. Carlsbad Sprudel or sodium phosphate, a teaspoonful in a tumbler of hot water, should be given an hour before breakfast and the mid-day meal. Crowe, from experiments on both animals and man, has shown that *wrotropine* (hexamethylenamina) is an excellent remedy for sterilizing the bile-passages. It should be given every four or six hours in large doses, 60 to 75 gr. (4 to 6 gm.) daily. The drug is usually well borne, but untoward symptoms, such as abdominal discomfort, pain on micturition, and hematuria, occasionally occur. Hot applications should be applied over the liver for an hour three or four times a day. If the disease is not influenced by treatment during four to six weeks, the advisability of surgical procedure should be thoroughly discussed. In suppurative cholangitis the treatment is purely surgical.

CHOLECYSTITIS

Etiologically this affection is associated nearly always with infections—pneumonia, influenza, colon bacillus, or pyogenic infections, typhoid. During the course of typhoid, bacilli are practically always present in pure culture in the gall-bladder. Other factors, like trauma, previous infections, gall-stones, stasis, favor the development of inflammation. In phlegmonous cholecystitis, due usually to pyogenic organisms or pneumococci, the picture may be that of an acute septic condition with few and ill-marked localizing signs. No time must be lost in attempting medical treatment, as rupture of the gall-bladder and general peritonitis frequently occur. Acute cholecystitis, primary or recurrent, may cause severe biliary colic, and attacks cannot clinically be distinguished from cholelithiasis. Pain must be controlled by hot poultices over the liver, a hot bath, or by hypodermic injection of morphine. If inflammatory signs are pronounced, it is best to give small doses of morphine, gr. $\frac{1}{16}$ to $\frac{1}{12}$, as larger amounts may mask important symptoms. Vomiting usually gives relief, and may be encouraged by copious draughts of hot water, to which bicarbonate of sodium has been added. A high enema of hot water may move the bowels and relieve flatulence. After the acute attack has subsided, epigastric distress, distention, and tenderness persist two or three days or a week or two. The patient should be kept absolutely quiet and on a liquid diet. A tumbler of hot Carlsbad water (Muehlbrunnen) should be given four or five times daily. Hot flaxseed poultices should be applied over the liver and frequently renewed; they should be continued until inflammation has subsided. From 60 to 90 gr. of urotropine a day should be given, as indicated in the paragraph on Cholangitis. Usually cases of acute cholecystitis subside in a few days under such treatment, but if toxemia continues or becomes more pronounced, if pain, local tenderness, and rigidity increase, and the leucocyte count rises, operation should be advised. The cholecystitis occurring during typhoid is often mild and manifested only by slight distention of the gall-bladder and moderate epigastric pain and tenderness. The importance of beginning treatment with urotropine in the early days of the disease has been sufficiently emphasized. The treatment of recurrent cholecystitis coincides with that of cholelithiasis.

CHOLELITHIASIS

Infection of the biliary tract undoubtedly plays the chief role in the formation of gall-stones, the typhoid, colon bacillus, and pyogenic organisms being most often at fault. Conditions favoring stasis in the bile-ducts or gall-bladder, such as obesity, sedentary life, adhesions, kinking of the ducts, or swelling from inflammation, are contributing but not chief causes. Many authors still hold to the idea of a primary humoral disorder, the so-called gall-stone diathesis of "lithogenous catarrh." A knowledge of the different factors at work in etiology is important for rational treatment.

Gall-stones are more common in women than in men, 5 to 1 (Schroe-

der), 3 to 1 (W. J. and C. H. Mayo); the more sedentary life in women, the relatively smaller size of the liver, increased demands made on the liver during pregnancy, increased liability to infection during pregnancy and parturition, constipation, enteroptosis, peculiarities of diet, and tight lacing have been advanced as causes of this difference. Infections of the alimentary tract—recurrent gastro-enteritis, appendicitis, and chronic constipation are important. Nearly all stones are formed in the gall-bladder as the result of catarrh following attenuated infections and disturbed drainage. In some instances they may be found in the common or hepatic ducts, but even then a stone from the gall-bladder which has lodged in the common duct is the prime offender, and the other stones are secondary. They are usually multiple, and usually all formed at one time, although in a few instances there may be several crops of different sizes. They may be formed in a few days or a few weeks. Cholesterin makes up the chief part of the stones, the rest being bilirubin, calcium, and mucus. The cholesterin does not come from the food or bile, but is formed by the action of the gall-bladder cells. It has not been proved that food influences the formation of stones other than through exciting gastro-intestinal catarrh or favoring liver congestion and consequent stasis of bile.

The medical treatment of cholelithiasis has been placed on a much more rational basis in the last few years, through the teaching of surgeons. We no longer attempt to dissolve stones or direct treatment chiefly to their removal by giving cholagogues which shall drive them from the gall-bladder. We recognize that disturbing symptoms are largely due to biliary infection, and the chief aim of treatment is to control this infection and restore harmony in the irritated gall-bladder and ducts. The gall-stones are thus rendered "latent" and quiescent. According to Riedel and Kehr, 95 per cent. of gall-stones may remain latent and may safely be let alone.

Attacks of biliary colic may be precipitated by exercise, trauma, emotion, exposure to chill, diet errors, and reduction cures (von Noorden). Menstruation, which may be associated with active hyperemia of the liver, not infrequently brings on an attack. Recurrent infection is the most potent factor. The attacks frequently come on during the night after an unusually hearty meal, especially after drinking wine. The pain is often atrocious, and a hypodermic of morphine, gr. $\frac{1}{3}$, with atropine, gr. $\frac{1}{100}$, should at once be given. The patient may be immersed in a hot bath or hot flaxseed poultices may be applied over the liver region. Drinking hot water may relieve distressing retching. If pain be intense, collapse may result and require treatment by injections of camphorated oil (30 to 60 minims). After the acute pain has passed, the patient should be kept in bed for two or three days. No food should be given for twenty-four hours, but hot water should be drunk freely. The bowels should be moved by enemata, or by Carlsbad salts, or sodium phosphate in hot water. Hot fomentations should be applied to the liver region until acute tenderness has disappeared.

With recurrence of acute cholecystitis, or with persistence of less

pronounced symptoms, a regular plan of treatment should be outlined. If possible, the regime should be inaugurated at some suitable watering-place—I prefer Carlsbad—but excellent results may be obtained at home. My personal scheme may be sketched as follows:

If signs of infection are still present, or if there is tenderness about the gall-bladder, epigastric discomfort, jaundice, the patient is kept in bed or reclining outdoors, and is not allowed to exercise. Hot fomentations are applied over the entire upper abdomen for an hour or two, three or four times daily. These fomentations are conveniently made by wringing a piece of blanket or crash toweling out in very hot water, applying in two thicknesses over the abdomen, and covering with dry toweling and oiled silk. A flat electrically heated pad over the bandage will keep it sufficiently hot.

Six ounces of hot Carlsbad water are administered slowly an hour before breakfast, and again in twenty minutes; 6 oz. are again given at 11 and 11.30 A. M. Occasionally the same amount is repeated at 3.30 and 4 P. M. In place of the Carlsbad water, a teaspoonful of the powdered Carlsbad salts may be dissolved in 12 oz. of hot water and given in the way indicated before breakfast and luncheon, or 1 or 2 teaspoonfuls of sodium phosphate may be substituted.

A liberal diet is allowed unless contraindicated by fever, jaundice, or gastro-intestinal disturbances. Fats are limited if jaundice is marked. No acid fruits, as oranges, grape-fruit, strawberries, or rhubarb, are allowed during the Carlsbad cure, but cooked pears, apples, and prunes may be permitted. All vegetables given are thoroughly cooked. Meat is permitted in moderate amounts twice daily. Alcohol, condiments, made gravies, and sweet desserts are prohibited. A small amount of black coffee, weak tea, or cocoa does no harm. Skimmed milk or buttermilk is given freely. The principal meals are taken at 8 A. M., 12.30, and 6.30 P. M. At 4 P. M. bread and butter with milk is given, and again at bedtime.

If the waters are not sufficient to move the bowels gently, the amount of saline is increased, or the colon is irrigated daily, or every other day with a quart or two of salt solution. If infection of the ducts or gall-bladder be pronounced, hexamethylenamine is given in doses of 45 to 60 gr. daily, or if this is not well tolerated, the combination suggested by Chauffard:

R.	Sodii salicylatis.....	gr. x	.6;
	Sodii benzoatis.....	gr. v	.3.—M.
	Fiat cachet No. i.		

A cachet is administered after meals three times daily with a half tumbler of water.

The initial cure is carried out for three or four weeks. If complete quiescence of the disease has been secured, the patient returns gradually to his ordinary duties and diet. Moderate exercise is now encouraged, five light meals daily are given, and the general treatment adopted that has been outlined in the sections treating of Biliousness and Congestion

of the Liver. During this period, drugs like calomel, rhubarb, salicylates, or bile preparations may occasionally be employed. The action of all cholagogues is questionable, and I have seen no particular advantage in the newer bile-salt preparations over sodium glycocholate and ox-bile. These may be given in 5-gr. capsules after meals, alone or combined with sodium bicarbonate or compound rhubarb powder.

In cases with stones in the common duct, I occasionally try the *olive oil treatment* recommended by Gilbert: 25 to 60 c.c. (1-2 oz.) are given in the morning, on an empty stomach, every four or five days. The amount is increased by 25 to 50 c.c. each time until 200 c.c. (7 oz.) are taken. I have found it better to introduce the oil through a stomach-tube. Chauffard and Dupré administer the olive oil at night in doses of 300 to 400 c.c. (10-13 oz.), or 100 c.c. every night for three nights. Hot colon irrigations seem occasionally beneficial.

If symptoms are not relieved by the Carlsbad treatment, it may be advantageous to adopt the plan outlined by Chauffard and Gilbert: The patient is kept on a strict skimmed milk diet for two weeks, $2\frac{1}{2}$ to $3\frac{1}{2}$ liters daily. At the end of this time, cooked vegetables or a little cooked fruit, a little dry toast and milk soups, with the addition of tapioca, vermicelli, and farina are permitted. At the end of another week, eggs and a little meat are added. A powder of sodium salicylate, gr. $7\frac{1}{2}$ to 10, with sodium benzoate, gr. 5, is given three or four times daily for twenty days out of each month for three or four months, then fifteen days a month, and finally, ten days. The entire treatment extends over a year.

If medical treatment is not controlling painful attacks or infection, or if stones remain in the common duct, causing obstructive jaundice, pancreatitis, or cholangitis, surgery should not be too long delayed. The patient should be properly prepared for operation and, if possible, this should be done during a quiescent stage. Hexamethylenamine may be given for three days preceding, 45 gr. daily. Water should be drunk freely, and the urine carefully examined, as suppression of urine following gall-stone operations is not uncommon. Chloroform should not be used as an anesthetic. In cases of long-continued obstructive jaundice, 60 to 80 gr. of calcium chloride or calcium lactate should be given in divided doses each day for two days preceding operation, to prevent hemorrhage. W. J. Taylor has recommended thyroid extract for the same purpose, and subcutaneous injection of fresh rabbit or of horse serum may be tried (20 to 30 c.c., $\frac{2}{3}$ to 1 oz.).

After operation has restored the integrity of the bile-passages, preventive treatment of future infections will be in order—diet, exercise, avoidance of alcohol and other irritants of the liver—and occasional courses of the alkaline mineral waters or of cholagogues like mercurials or salicylates.

DISEASES OF THE PANCREAS

Through the work of physiologists, clinicians, and surgeons, a number of interesting facts have been gathered in recent years in regard to the pancreas, but their influence on therapeutics has been slight. Byron Bramwell, Thomson, and others have reported cases of infantilism with deficient pancreatic secretion, in which benefit followed administration of pancreatic extract. In cases of disturbance of the external secretion with steatorrhea and azotorrhea, pancreatic preparations may be of decided value. The juice or pulp of fresh glands from calves or pigs may be given, but pancreatin and pancreon offer a much easier method of administration; 5 to 10 gr. of pancreatin, with the same quantity of sodium bicarbonate, may be given one-half hour before or two hours after meals. von Noorden recommends pancreon in doses of 6 to 8 gm. ($1\frac{1}{2}$ to 2 drams) daily, with the same amount of carbonate of lime (prepared chalk).

Many tests have been proposed for the determination of pancreatic insufficiency, but they are by no means unequivocal. If the presumption of deficient secretion seems well founded, the above pancreatic preparations may be given a trial. Hydrochloric acid is a rational stimulant to pancreatic activity. Experimentally there is no better way to increase pancreatic secretion than to extract the duodenal mucosa with hydrochloric acid, neutralize, and inject intravenously. Secretin has been used therapeutically by Moore, Dakin, Foster, and others in disturbances of both external and internal secretions of the pancreas, but the results have been contradictory. Pilocarpine may also be given as a pancreatic stimulant. In diabetes, pancreatic preparations have been used alone and in combination with other glandular or muscle extracts, but without definite results.

PANCREATITIS

The treatment of acute hemorrhagic, suppurative, and gangrenous pancreatitis is essentially surgical. Morphine hypodermically will be required for the intense abdominal pain. Collapse should be treated by hypodermic injection of camphor or caffeine, or by intravenous injection of salt solution—8 oz. with 10 drops of adrenalin (1 to 1000 solution). Vomiting may be controlled by lavage with hot water, and hot enemata should be given to reduce meteorism and relieve obstipation. Chronic pancreatitis is found most often associated with portal cirrhosis, cholelithiasis, and chronic ulcers of the stomach and duodenum; the treatment is that of the underlying cause.

SYPHILIS OF THE PANCREAS

The Wassermann reaction now enables us to determine the syphilitic nature of some indefinite deep-seated abdominal tumors. In 2 cases I have seen, specific treatment has led to cure of severe types of diabetes due to syphilitic disease of the pancreas.

PANCREATIC CALCULI

Symptoms are much the same as in cholelithiasis, and diagnosis can only rarely be made. Efforts have been made to increase the flow of pancreatic juice, with the idea of forcing out the calculi. The use of pilocarpine injections, as suggested by Eichhorst, would be contraindicated by the weight of experimental evidence. In a few cases stones have been removed by operation (Körte, Gould, Moynihan).

CANCER OF THE PANCREAS

The treatment is purely symptomatic. Gastro-enterostomy may relieve vomiting due to narrowing of the duodenum or pylorus. Cholecystenterostomy may free the patient from the intolerable itching of jaundice. Pancreatin and bicarbonate of sodium are indicated in cases with steatorrhea and azotorrhea.

PART IV

THE TREATMENT OF DISEASES OF THE RESPIRATORY SYSTEM

DISEASES OF THE NASAL CHAMBERS, PHARYNX, AND LARYNX. MEDICAL TREATMENT

By GEORGE FETTEROLF, M.D.

PROPHYLAXIS.

WHILE the scope of this article is indicated by its title, it may not be amiss to go slightly beyond the strict letter and devote a certain amount of attention to the prophylaxis of some of the diseases of the upper air passages. The longer one practises laryngology the more clearly is it seen that all too frequently, after examining the upper air passages of a patient, the verdict of incurability has to be given. Coincidentally one knows that only neglect of certain very simple precautions and hygienic measures has given rise to the trouble. Were these precautions difficult of adoption or the measures difficult of execution one would not perhaps urge them so strongly, but they are so easy of performance and of such proved efficacy that it seems deplorable that they are not in more general use.

The measures in question involve both the care of the upper air passages and that of the general body condition, both of which should be begun in childhood. If the child habitually breathes through his mouth, struggles for breath at night or while eating or drinking, awakes in terror from his sleep, or suffers from earache, he should be examined for the presence of hypertrophied adenoid and tonsil tissue, and any existing overgrowth removed. If he suffer from a chronic nasal discharge, the source and cause of such flow should be sought. It will usually be found to be due to infected adenoids, accessory sinus disease, inherited specific taint, or structural change in the nasal mucosa; whatever be the cause it should be removed by appropriate treatment. The teeth should be well cared for. The role of tender and carious teeth in the production of gastro-intestinal disorders is well known. The ears should be examined

occasionally. While cerumen collections are not frequent in childhood, they occur sufficiently often to make advisable routine examination for their presence. Prolonged pressure by a mass of impacted cerumen cannot fail to cause changes in the tympanic membrane, and by interference with hearing delay the intellectual development of the child.

As regards general measures, there are two prime requisites in the prevention of frequent nasopharyngeal infections—the breathing of fresh air to the greatest possible extent, and the keeping of the skin in the highest condition of tone. Both the medical profession and the laity have been enlightened to a great extent in these respects, especially the former, by the recent activity in the study and treatment of tuberculosis. All who read have been taught the innocuousness of cold air, and much sound sense is rapidly filtering into the every-day life of all of us. More and more are city dwellers moving to the country, country clubs are flourishing, motor cars are multiplying, architects are being asked to put sleeping porches to houses, all the signs are pointing to a more rational and hygienic mode of living. It cannot be emphasized too strongly that plenty of ventilation, especially of the bedroom, even in the bitterest of cold weather, is not only a highly beneficial procedure, but an absolutely necessary one. In advising this the physician has to inquire into details, for a great many sins are committed in the name of ventilation. Ask a patient if his bedroom is well ventilated, and he will usually answer in the affirmative. Inquire as to how widely the windows are opened, and in more than 50 per cent. it will be found that a few inches of raising of the lower sash is the extent. The fundamental idea seems to keep the room so warm that it will be comfortable for dressing purposes in the morning. There are very few, however, who cannot separate their dressing from their sleeping quarters, and when the importance of a maximum of air is impressed upon the patient a way to attain this is usually found. If once the desire to have a cold sleeping room is aroused, there is little trouble in finding a way. It makes no difference how cold the room is, provided that the occupant is warm; no good, but much harm, is done by being cold while sleeping in a cold room. But if the sleeper is warmly clad, with, if necessary, a hot-water bottle or two in his bed, and flannel instead of linen or cotton sheets to sleep between, he will awake in the morning with a degree of mental and physical alertness quite different from his feelings after sleeping in a warm and ill-ventilated room.

Then, on arising, comes the bath. This should by all means be of the cold variety. When a patient is instructed to take a morning cold bath, in nine cases out of ten the answer comes that he cannot do so, the shock is too great, etc. In the crude form of cold bath this is usually true, but if a little *finesse* be used, and the patient's feelings considered and his prejudices met, there are none except the aged who cannot be brought to endure and profit by the procedure. There are comparatively few who can jump into and enjoy a tubful of cold water during the entire year, and the enjoyment part of it is very important, as unless the bath is a pleasure it will usually be discontinued. Patients of mine who have

to be educated and instructed along this line are told to proceed as follows: First, draw a few inches of comfortably warm water into the tub and get into it and take a cleansing bath. Then they attach a rubber bath spray with a watering-pot nozzle to the faucet and spray themselves thoroughly with warm water. After they have done this they gradually turn off the warm water faucet and continue spraying the body with water, which is necessarily getting colder, eventually turning off as much of the warm faucet as they can stand. After doing this for a number of days they usually find that they can turn off all the warm water and not only endure but take pleasure in douching their skin with the water as it comes from the cold faucet. By this little maneuver practically everyone can secure the benefits and enjoy the pleasures of the morning cold tub, with none of the discomforts of a plunge directly into cold water. Needless to state, the bathroom should be well warmed, and in cold weather the bath should be followed by a brisk rubbing with a rough towel, and in warm weather by a gentle patting, so as not to start the day with a perspiring skin and moist underwear.

The form of underwear worn is all important. In the summer this part of the clothing does not demand the attention which is required in the colder seasons. I mention only to condemn wool, silk, balbriggan, and the various forms of abbreviated garments so much in favor with the youth of the college age. All of them are deficient in air circulation, and all of them are prone to retain for a long time any perspiration that may wet them. This latter is a great evil, for if one goes into the cold air with moist woollen or balbriggan underwear, as soon the cold reaches it the water is chilled, and there begins at once an abstraction of heat from and a chilling of the skin, which soon results in those bodily changes which we call a "cold." In some way resisting power is lowered and the ever-present germs are allowed to become active, with the result that an acute catarrhal process is set up somewhere in the body, usually in the upper air passages, but sometimes in the lungs, the gastro-intestinal tract, the genito-urinary tract, generally in what is in a given individual the *locus minoris resistentiæ*.

These evils are done away with by the use of some form of mesh underwear, either linen or cotton, the material being of no importance except as affecting the pocket-book. The principle of construction is the main thing, viz., two connected layers of loose fabric, between which is a space for a layer of air. This eliminates from consideration the fishnet shirt, which while most comfortable in summer is most unhealthful in winter. With a true mesh there are several advantages. One is that there is practically next to the skin a slowly and freely changing layer of air, and this, as is well known, is a poor conductor of heat. Sudden heat abstraction from the skin is, therefore, an impossibility, and one result of this is very noticeable, and is usually remarked upon by people who put on this kind of clothing for the first time—there is entire absence of that preliminary chill generally experienced in going out on a cold day. There is warmth and comfort right from the start. Another advantage is that when the wearer is in the house and perspires, the underclothing

does not become saturated and lie like a wet poultice next to the skin. A third point in its favor is that it dries quickly, a feature of great value in cold weather, as sudden chilling of portions of the chest integument is prevented.

This form of underwear can and should be worn by the young, the full grown, the aged, the thin, the stout, the anemic, the plethoric. One detail should be carefully attended to, viz., that it fit the body closely. Unless this condition is fulfilled much of the good is lost. It can be changed to from heavy woollens in the middle of winter with no results but good ones. It sometimes requires great persuasion to cause its adoption under such circumstances, but persistence will usually win out. In spite of the amount of persuasion and argument which is sometimes required to cause patients to change from heavy, thick underwear to the mesh, considerable rebellion will sometimes be met with, but the result is worth the energy expended. Of the hundreds I have had make the change none have reverted to their former garments and none are dissatisfied. My experience has shown me very clearly that if I can get patients to take a morning cold bath and wear some form of mesh underwear, with ordinary precautions acute catarrhal diseases are practically abolished for that patient.

To recapitulate: In order to prevent catarrhal troubles of the upper air passages which may cause or leave incurable sequels, (1) attend carefully to the nose, throat, ears, and teeth of the child; (2) have plenty of good, clean air breathed as many of the twenty-four hours as is possible, and (3) keep the skin in good condition by means of a daily morning cold bath and the wearing of some variety of mesh underwear.

DISEASES OF THE NASAL CHAMBERS.

ACUTE RHINITIS.

The condition is due to the activity of an undetermined micro-organism in an individual in whom for some reason resistance has been acutely lowered by disturbance in the balance of the circulation. Treatment must be regulated by the dominant etiological factors.

Chilling of the body surface which is not overcome by a compensating supply of blood to the skin will be followed by a cold, provided the infecting agent is present. One experience of the Shackelton expedition to the South Pole is very instructive. After the small selected polar party had left the main expedition there was naturally nothing infectious with which they could come in contact excepting what they carried with them. In spite of the extremely low temperatures to which they were subjected, they were entirely free from colds until necessity compelled them to unpack a bundle of blankets which had not been opened since they had left civilization. Almost immediately there was an epidemic of acute

coryza, after the subsidence of which there was no further trouble of this kind. This is a rather unique and decidedly incontrovertible proof of the infectiousness of this condition or disorder.

Therapeusis should be directed along two lines—the restoration of the balance of the circulation, and such general and local remedial measures as will limit the nasopharyngeal infection in extent and duration and give the patient the greatest possible relief. It will necessarily have to be carried out along different lines, according to whether the patient can remain indoors or is compelled to be at his occupation. In the case of the former, and if the disease is caught at the outset, the patient should be given a hot drink of some sort, containing about an ounce of whisky, along with which the time-honored remedy of a hot foot bath should be administered. He should then be put to bed, covered warmly with bed-clothes, and gr. x (0.6) of Dover's powder administered. Then as soon as possible a course of ten doses of calomel should be instituted, gr. $\frac{1}{10}$ (0.006) being taken every half-hour. An hour after the ingestion of the last dose a saline laxative should be taken. In place of the calomel and saline, especially in children, a full dose of castor oil may be given. This should be followed by at least one and better two days in bed. In those of advanced years this should always be insisted upon.

If the case has to be an ambulatory one, there is nothing better than a short period of violent exercise, such as tennis, handball, rackets, squash tennis or squash rackets, running, sparring—anything which will cause active muscular movements with perspiration and increased elimination of waste products. The exercise should be followed by a short period of rest, thirst being assuaged by a glass or two of hot water, this in turn being followed by first a hot and then a cold shower or tub bath. A course of calomel and saline or a dose of castor oil should then be given. By these procedures the circulation is equalized, the skin is thoroughly warmed and cleansed, and the first and most important step in the management of a cold is taken.

Further general treatment is the same for both classes of cases. Without doubt a strict diet of water only for twenty-four hours is of great value, but this can rarely be attained. One usually has to be satisfied with a diet of eggs in various forms, dry or milk toast, and tea. For internal administration the following has been my standby for years:

Cinchonine dihydrobromate	gr. xvj	(1.0)
Phenacetin	gr. xxxij	(2.0)
Salol	gr. xlviij	(3.0)
M. et div. in capsul. xvi.		
Sig.—One capsule every four hours.		

Considerable relief can be afforded by treatment of the nasopharyngeal mucosa, although it is questionable whether the course of the disease is shortened thereby. The indications are to reduce as far as possible the annoying engorgement of the mucous membrane and to remove the excessive discharge. In order to accomplish the latter, the former will have to be done first, and this can be accomplished best by spraying the

nose with the following solution, a solution which, like all preparations of cocaine, should never be put into the hands of patients:

Antipyrine	gr. v	(0.3)
Cocaine hydrochlorate	gr. x	(0.6)
Normal salt solution	f 3j	(30.0)—M.

Sig.—To be used locally as a spray.

It will take ten to fifteen minutes to shrink down the nasal mucosa, because the inferior turbinated bodies will usually have to be reduced before the upper ones can be reached. It is best to spray a few drops into each nostril, always under illumination, wait a few moments, spray a few more drops, and again wait a few moments, continuing this procedure until instead of a deeply engorged and swollen membrane filling the nose, one finds a patulous cavity whose lining can readily be reached for treatment. Then should come the cleansing of the nose, which should be done with an atomizer and postnasal syringe, using a solution which should have three characteristics: It should be alkaline, it should be warmed to about body temperature, and it should have approximately the same specific gravity as the blood. The solution should be alkaline, in order to dissolve with greater readiness the accumulated mucus; it should be warmed, on account of the tenderness of the nasal mucous lining; and its specific gravity should be about that of the blood, in order to prevent osmosis in either direction. With the atomizer the nose should be gently but thoroughly sprayed, and then with a postnasal syringe, carefully introduced behind the soft palate, 15 to 20 drops of the same solution should be injected into the nasopharynx. If the nostrils have been rendered patulous, the syringe gently used and only a small quantity of solution injected, there is no danger or discomfort in the procedure. The integrity of the Eustachian tube and middle ear are not only not endangered, but the possibility of their infection is distinctly lessened.

The solutions I most commonly use are normal salt solution and the official liq. alalin. antiseptic., diluted to 25 per cent. strength.

After thus clearing the nose and nasopharynx of their accumulations, aided by the patient blowing his nose, the treatment should be completed by spraying the nose and throat with some bland oil. My feeling is that nothing is gained by using the ingredients of the oil in any great strength, my usual formula being simply:

Menthol,		
Camphor	āā	gr. j (0.6)
Liquid petrolatum (white)	f 3j	(30.6)—M.

Sig.—Use locally as spray.

This treatment can be used daily if the patient can and will report for it, and as home treatment a watery cleansing spray, followed by the oil spray, both used four times a day, will give all the comfort possible under the circumstances:

CHRONIC RHINITIS.

While each form of nasal inflammation requires suitable local treatment, there are certain principles of general management which are common to all. There is probably no region of the body in which a careful study of the details of a patient's life will bring a greater reward, as many an annoying and obstinate condition can be cleared up by altering certain habits and customs. A case seen within the last year illustrated this very well. This patient came to me complaining of attacks of sneezing on arising in the morning, along with nasal obstruction and irritation which lasted the greater part of the morning and passed away as the day waned. Various local medicaments had been used, with no effect, and the patient was rather skeptical as to the condition being curable. Examination of the nose showed engorgement of the whole nasal mucosa, with slight hypersecretion. Close inquiry into the morning program revealed the fact that the patient slept in a cold room in winter, and was accustomed to walk from the side of his bed to the bathroom in his bare feet. He was instructed to have fleece-lined slippers at hand, and to put them on before stepping on the floor. No other treatment was given or ordered. The result of this was that his sneezing attacks and nasal obstruction disappeared in a few days and have not returned. Without this little common-sense procedure his trouble probably would have continued indefinitely.

This case exemplifies the line to be adopted, viz., the most minute inquiry into the patient's life. Details investigated should include clothing, bathing, exercise, ventilation of office, living rooms, and bedroom, habits as regard food, alcohol, tea and coffee, tobacco, and sexual indulgence. Along with these should be a search for any specific or tuberculous taint, or the presence of any other disease. In a word, the patient's life and body should undergo the most careful scrutiny and all factors of deleterious influence eliminated.

Of special importance in correcting nasal troubles are cold bathing, proper underwear, and ample ventilation, matters which I have discussed in detail in the section headed Prophylaxis. Along with these are certain local measures applicable to particular forms of chronic nasal disease.

Simple Chronic Rhinitis.—As this condition is characterized by turgescence of the nasal mucosa, especially of the inferior and middle turbinates, along with which is perversion of secretion, the indications are to reduce the engorgement and to endeavor to cause a return to normal of the nasal secretions.

Cleanliness of the nasal cavity being an important desideratum, the patient should cleanse the nose at least twice daily. Nothing has proved so efficient in my hands as a solution of sea salt, in the use of which the patient is instructed as follows: A quantity of sea salt is washed, dried, and pulverized. Of this, two rounded teaspoonfuls are put into a pint bottle of water and allowed to dissolve. Every morning and evening the patient pours about 1 ounce of this solution into a glass and adds to

it an equal quantity of warm water, of a temperature to make the resulting mixture about body heat. This plan is adopted simply to facilitate warming the solution. Then by means of a Davol rubber or Birmingham glass douche the entire 2 ounces are used in the nose, first a little in one nostril and then in the other.

I rather prefer the rubber douche, as in using a glass one there is a tendency for the patient to sniff up the solution and thus endanger the Eustachian tube. In using it the patient should stand face downward over a basin, with his mouth open. Little force should be used in injecting the solution, and only a small amount, not more than fʒj (4.0), thrown in at a time. A few days of this will show the patient how to perform the act, and it can soon be done with no discomfort and much relief.

The physician's part in treating such cases locally consists in cleansing the nose at each visit and applying the proper medicaments. The best drug for the purpose is iodine in the form of a watery solution. I use solutions of 1, 2, and 3 per cent. strength, beginning with the weakest and working up to the strongest. It should be applied by an applicator and cotton to all parts showing swelling of the mucosa, and should also be applied to the vault of the pharynx, which is almost invariably involved concurrently with the nose. Following the local application the nose should be sprayed with an oil such as menthol, camphor, āā gr. j (0.06); liquid petrolatum (white), fʒj (30.0).

To reduce the swollen mucosa other solutions may be used, such as zinc sulphate in 1 per cent. solution, or the patient may wear in the nose a soft rubber or malleable metal splint, the pressure being applied to the swollen turbinals. These measures failing, some surgical procedure must be adopted.

Hypertrophic Rhinitis.—In this form there is a distinct cellular hyperplasia, and the obstructing tissue must be removed. For cleansing the nose the sea-salt solution mentioned above should be used by the patient at home. Some shrinkage of the swollen turbinals can be accomplished by massaging with the iodine solutions mentioned above. The hypertrophied turbinal should be first cocaineized, and then a cotton-tipped applicator dipped in a 2 per cent. aqueous solution of iodine is rapidly moved to and fro over the swollen tissue. If persisted in this will sometimes cause decided shrinkage. Usually, however, resource must be had to some of the various methods of cauterizing or ablating the offending tissue.

Atrophic Rhinitis.—While the pathology of this disease is well known, its etiology is purely speculative, and hence its treatment symptomatic and very unsatisfactory. It is a most discouraging disease to treat, not to speak of the unpleasantness, and the most sanguine of rhinologists will give only an unfavorable prognosis.

The indications in applying local treatment are to attack any discoverable cause, to keep the nose as clean as possible, to endeavor to excite a maximum of life and activity in the nasal mucosa, and to spare to the utmost the patient's associates by reducing the odor to a minimum.

As regards cause, there are two classes in which treatment directed

along etiological lines will probably meet with some success, viz., those due to syphilis and those in which chronic disease of the nasal accessory sources can be proved. All sufferers from atrophic rhinitis should either be subjected to a Wassermann test or be given a course of iodide of potassium, beginning with gr. xv (1.0) a day and increasing gr. iij (0.18) every other day until iodism develops, or the presence of syphilis is demonstrated by the amount of the iodide the patient can absorb. In the latter event considerable improvement in the nasal condition can be expected, the first change being that the character of the crust will alter from thick, adherent gumminess to thin and readily detachable softness. Along with this will come an improvement in the appearance and secretion of the mucous membrane.

If sinus trouble can be demonstrated, properly directed surgical measures should be adopted.

In the remaining cases one can simply cleanse and stimulate the nasal lining and try to deodorize the nose.

As regards cleansing: This will have to be done by the patient as well as by the physician, although the former can rarely secure a complete removal of the inspissated discharge. The best solution to be used, taking everything into consideration, is normal salt solution or the sea-salt solution mentioned above. These should be used in some form of rubber nasal douche, and the solution should be heated to about blood heat. If in spite of repeated douching the patient is not successful in removing the crusts, he should be furnished with a nasal applicator and shown how to wrap the end with cotton and use it for the purpose of dislodging adherent scabs. There is no danger in this, as no one will use sufficient force to do himself any damage.

For deodorizing purposes I have my patients purchase a quantity of potassium permanganate crystals. After using the salt solution and applicator they are told to drop a few permanganate crystals into a tumbler of warm water, making the solution about the color of claret. This entire tumblerful is douched into the nostrils alternately. This will usually result in removing for a time the odor and make the patient tolerable to his associates.

As regards treatment by the physician: The first essential is absolute and complete removal of the nasal accumulations. This is an exceedingly unpleasant procedure, and to render it as little annoying as possible it is not a bad plan to introduce into one's nostrils a small pledget of cotton soaked in a solution of menthol.

The removal can be accomplished more easily if the nose is first packed with cotton saturated with an oil, such as liquid white vaseline. Both nostrils can be packed full of these pledgets and the patient allowed to wait for fifteen minutes, after which he can be brought again into the office, the pledgets withdrawn, and the secretions attacked. They are removed most readily by means of a long, narrow-tipped atomizer, which can be introduced well up into the nostril and the stream directed against any crust which is adherent. If necessary, forceps, a cotton-tipped applicator, or a curette can be used in dislodging obstinate accumulations.

After the nose has been thoroughly cleaned there is almost an endless choice of local applications that can be used. No matter what is selected, there are two things that should be borne in mind. One is, that every part of the nasal interior should be reached, and the other is, that a certain amount of friction of the membrane should accompany the application.

Among the more effective medicaments which may be tried are a solution of menthol in oil, 10, 15 or 20 gr. to the ounce (0.6, 1.0, or 1.3 to 30.0), 25 per cent. argyrol or protargol solution, 2 per cent. sulphocarbolate of zinc solution and ichthyol in increasing strength, beginning at 10 per cent. and running up to the pure drug. Powders which have achieved a certain amount of success are stearate of zinc, either alone or containing 1 or 2 per cent. of powdered silver nitrate, and 25 per cent. citric acid in sugar of milk.

To recapitulate, in treating this disease the cause should be sought for. Each patient should have either a therapeutic or Wassermann test for syphilis. The nose should be thoroughly cleansed, whatever is applied locally should be thoroughly applied, and finally one should be prepared to have the treatment result in very little being accomplished. Sometimes the patient will be largely benefited, but this is the exception rather than the rule.

ACUTE SINUSITIS.

Next to acute otitis media, acute inflammation of one or more of the nasal accessory sinuses is the most common complication of an acute cold. Signs of this disorder should always be looked for, any pain in the head during the course of a coryza, especially if the latter be of the influenzal variety, to be regarded not as neuralgic, but as indicating extension of the process to the mucosa of the cavities accessory to the nose.

The therapeutic indication in such a condition is one only, viz., the securing and the maintaining of the freest possible drainage of the infected cavity or cavities. Having made a diagnosis of the location and extent of the involvement by noting the position of the pain and tenderness, and by determining by means of nasal examination the point from which the discharge is coming, the same principles of treatment will apply to all, no matter where the disease is seated.

As regards general treatment, the patient should be put to bed at once and kept there until the sinusitis has largely cleared up. This is necessary not only to make the course of the disease as short as possible, but also to diminish the severity and duration of the pain. In addition, it will tend to keep the patient in as good condition as is possible in the event of operation being required, of complications arising in the form of extension to the meninges, orbit, cranial bones, or blood sinuses, or in case some concurrent disease is present. This last-mentioned contingency was brought very forcibly to my attention during the last summer by a patient with acute frontal sinusitis in whom a high temperature,

frontal headache, and mild delirium persisted in spite of the subsidence of the local pain and tenderness, along with very evident free drainage of the sinus. The leukocyte count on succeeding days showed the presence of first 9000, then 7500, and then 4500. The last count gave us a clue to the situation, for while Widal and paratyphoid tests were negative, a blood culture demonstrated the presence of the bacillus typhosus. The pus from the nose gave a pure culture of *Staphylococcus pyogenes aureus*. Having been kept in bed during the course of the sinusitis, the patient was in the best possible condition to resist the typhoid infection.

In addition to strict rest in bed, the patient should have the bowels kept open and should be allowed to have only liquid diet as long as his temperature is above 100° F. If possible, a daily leukocyte count should be made, so that the earliest possible warning of any extension of the disease should be received.

For internal administration nothing is better than atropine sulphate, the average dosage being gr. $\frac{1}{8000}$ (0.0001) t. i. d.

As regards local treatment, I feel very strongly that this can be and too often is overdone, to the very great detriment of the patient. The situation to be dealt with is this: A bony cavity with walls thick, thin, or both thick and thin, whose thin mucous lining is the seat of an acute suppurative process, whose normal opening is narrowed by purulent discharge and thickened mucosa, and which is separated from two very important cavities, the cranium and the orbit, by thin bony walls. In addition, the sinus opens into the nose, a cavity whose mucosa responds readily to any irritating agent, be it instrumental or medicinal. The therapeutic principle to be kept before the attending physician is, therefore, to try to open and keep open the normal ostium or ostia and to do this by the mildest possible means, always keeping in mind the fact that any trauma or irritation of the nasal mucosa will very likely result in narrowing or closing the normal openings, and in making rents in the mucous membrane through which infection and extension to neighboring or distant parts will be facilitated. This opening and keeping open of the sinus ostia can be accomplished best by using one of the preparations of the adrenal body in rather high dilution. The following simple formula has proved very efficacious:

Adrenalin chloride solution	f3j (4.0)
Normal salt solution q. s. ad	f3j (30.0)

Cocaine is left out of the mixture advisedly, as the adrenalin will produce all the shrinking of the mucosa that is necessary, and, as the solution may have to be used continuously for some days, there is too much danger of exciting the habit. The solution should be used in an atomizer with a blue or brown glass bottle and sprayed into the nose every waking hour during the acuteness of the attack. By using this formula at short intervals the constricting effects of the adrenal solution is rendered continuous and the mucosa is not allowed to relax and close the mouth of the infected sinus. If the discharge is very free, as is likely to be the case in the first week of the disease, the adrenal spray should be followed by

a spray of warm normal salt solution, the cleansing of the nose being a very grateful procedure to the patient. In the later days, as the discharge lessens in quantity, it tends to dry and form crusts, and then an oil spray such as the following will be found successful in preventing these accumulations:

R—Menthol,
 Camphor āā gr. ij (0.12)
 Liquid petrolatum (white) f3j (30.00)

This should be sprayed into the nose immediately after cleansing with the normal salt solution.

There is one feature of the disease which often calls for active intervention, and that is the pain, which frequently is agonizing in its intensity. It is due to the accumulation of pus in the infected cavity, the severity being caused by the retention of the discharge within a cavity with unyielding bony walls. It is not relieved until an exit is afforded for the escape of the pus. If this is not accomplished by the use of the astringent spray mentioned above, more radical means must be resorted to. It is done best in the following manner: The attending physician should spray the nostril with a 5 per cent. solution of cocaine until the mucosa is insensitive. Then a pledget of cotton should be soaked in the same solution and gently packed up between the middle and superior turbinated bodies. This should be allowed to remain for ten minutes and then be removed and replaced by a similar pledget. After this has remained in place for ten minutes it should be withdrawn and the middle meatus inspected for pus. If it is seen flowing and relief of pain follows, nothing further need be done. If pus does not appear, or does appear, and is not followed in fifteen minutes by relief of pain, the region above the middle turbinal should be treated similarly to the middle meatus. Unless the infected sinus be the sphenoid, some degree of comfort will usually follow. After the pus starts to flow the region from which it comes should be well sprayed with the adrenal solution described above.

The sphenoidal sinus cannot be reached and treated adequately unless surgical measures are resorted to.

While waiting for drainage to be secured the pain frequently is so severe that an opiate must be administered. It is ordinarily useless to use the coal-tar analgesics, although the pains of an influenzal infection are somewhat modified by them. Nothing short of morphine will be of any material use, and there should be no hesitation in giving it in full dose, at the same time administering a saline laxative to overcome the constipating effect of the morphine.

A hot-water bottle or hot salt bag applied over the forehead and temple sometimes seems to aid in subduing the pain.

The first sign to indicate that the disease is on the decline is the appearance of the pain at a later hour than on the previous day. This is a point of prognostic value and of great comfort to the patient. When this happens the frequency of the spraying can be reduced and the usual freedoms and liberties of convalescence allowed. After the acute attack

is over the patient should consult a rhinologist, for infection of the nasal accessory sinuses, with the exception of tooth infection of the antrum, does not usually take place unless there is some crowding of the tissues near the ostia of the cavities.

HAY FEVER.

The situation one meets in this disease is that of an individual the mucous membranes of whose upper air passages are peculiarly susceptible to the irritating effects of certain substances contained in the air. It is commonly accepted that there are two predisposing causes, some form of local nasal disease and a neurotic temperament; to these has been added in recent years a condition of uricacidemia. However, these generalizations are far from being invariable truths, for the reasons that cases are seen in which there is no chronic disease of the nasal chambers, the affection is found in the phlegmatic as well as in the neurotic, and it occurs in those in whom there is no tendency toward overproduction or underelimination of uric acid. In other words, the real fundamental predisposing cause of the disease has yet to be discovered, and under these circumstances it is perhaps natural that treatment is more or less haphazard and frequently unsatisfactory.

Treatment is indicated both before the attack and during it, and of these the former is the more important. Before the attack the indications are to put the individual in the best possible condition to resist the particular irritant which is the cause of his disease, this statement applying equally well to his nasal chambers and to his general bodily condition.

During the attack the endeavor should be to keep the patient's system and nasal mucous membrane up to the highest point of efficiency, and to keep separated as widely as possible the patient and the air-contained cause of the attack.

As regards general treatment: If the patient is below par in any respect, he should be built up. If he is in too high a condition of flesh and fat, he should be put on a course of diet and exercise to reduce his plethora. If he shows a lithemic tendency, proper diet, exercise, clothing, bathing, ventilation, etc., should be ordered. He should also, if necessary, be given a daily laxative, there being nothing better than a small teaspoonful of sodium phosphate administered in a cup of hot water on arising.

As regards his nose: Free respiration should be established in both nostrils. Any decided irregularity of the septum should be corrected, curvatures being straightened and spurs removed; all hypertrophied tissue, or obstructions such as polypi should be removed. If the patient can state with any certainty the time at which the attack can be expected, his nose should receive a thorough examination a week or two before the anticipated onset. At this time the condition of the turbinals particularly should be noted and any swelling reduced by cauterization. This procedure will relieve to some extent the nasal obstruction present during the attack.

Treatment during the attack: The indications here are to keep the irritating cause, usually pollen of some sort, away from the patient's respiratory mucous membrane. The best thing of all to do is to have the patient go away to some immune region, the best known resort for this purpose being Bethlehem in the White Mountains. Other favorable localities are the Isles of Shoals, N. H.; Campobello, Me., and Banff, in the Canadian Rocky Mountains. A pleasant method of avoiding the disease is to camp among the evergreens of Canada. The next most favorable location is the seashore, and preferably a resort which is bounded on both sides by water, and the broader the stretch of water between the resort and the mainland the better for the patient. When a sea breeze is blowing there is naturally no pollen being carried in the air, and the patient usually enjoys comparative comfort. When a land breeze is blowing the air is usually laden to some extent with pollen, and some discomfort is the usual result. The best places on the New Jersey Coast are Beach Haven and Longport.

If the patient cannot go away he should avoid the country, dust, and close proximity to horses, the latter because horse emanations are the source of considerable irritation to some sufferers. Draughts, either natural or artificial, as from an electric fan, should be avoided, as a steady current and fresh supply of dust and pollen laden air are being brought to the respiratory mucous membrane. For the same reason ocean travel is preferable to railroad journeys.

A certain degree of relief can be secured if on returning home a Turkish wash cloth or towel is saturated in hot water and placed over the mouth, nose, and eyes, and respiration carried on through this covering. It may require an hour or two, but the result usually is that the nose becomes free, and the itching of the eyes and throat is distinctly ameliorated. During the early days of the attack a cold shower or sponge bath will give some comfort, as it seems to aid in temporarily restoring tone to the vasomotor system.

The use of two pillows instead of one is advisable, for the higher position of the head seems to lessen to some extent the tendency to nasal congestion.

When the nasal secretion is very watery and profuse, a small dose of atropine, gr. $\frac{1}{800}$ (0.0002), repeated as may be required, will be found of use.

Exercise, both active and passive, are of benefit to the patient, the latter especially in the form of deep massage to the neck, which often affords temporary relief. Moderate active exercise should be taken late in the day, as near sundown as possible. The most uncomfortable time for the sufferer is usually between about 11 A.M. and 3 P.M., possibly because the heat at that time dries and spreads the pollen to the greatest extent. During that time, therefore, activity out-of-doors should be avoided and not indulged in until later in the day. Of the various forms of exercise, those in and on the water, such as swimming, rowing, canoeing, and sailing, should be chosen, the reason for this being obvious.

Exposure to glaring sunlight should always be avoided, if possible, as more or less photophobia is often present during the height of the attack. If such exposure cannot be avoided the wearing of *dark* smoked glasses is often attended with great relief to eyes and nose.

Some comfort can be obtained at night by the arranging, in the patient's home, of an immune room. Before the expected time of onset of the attack, usually about the middle of August, silk, cheese-cloth, or cotton should be tacked up over the windows, and the door kept closed. The patient should undress in another room, bathing throughout, including the hair, before retiring, and sleep in this room. By this means the introduction of the pollen into the room is prevented to a certain extent and a comparatively comfortable night may be enjoyed.

As regards local applications, the first and most important thing to remember is that cocaine should under no circumstances be given to the patient. The attack is so prolonged and cocaine would have to be used in so great an amount that the establishment of a drug habit would be almost inevitable.

Of available medical measures are cotton or cotton-wool impregnated with menthol, pledgets of which may be placed in the nostrils at any and all times of the day. An oily spray of liquid vaseline containing 1 to 5 grains each of menthol and camphor to the ounce may give some relief. This can be conveniently carried around in a hard rubber, vest pocket atomizer and used as frequently as the patient desires. Solutions of the active principle of the adrenal body may be used in the same way, the strength of the solution varying from 1 to 10,000 up to 1 to 3000, according to the needs of the individual patient. Pollantin, preferably in the form of a powder, will give relief in some cases, but its action should be carefully watched, as in some patients it distinctly aggravates the disease. The same is true of graminol.

Office treatment by the physician is usually a waste of time on the part of both physician and patient, providing the nose has been put in the best possible condition before the attack has come on. If this has not been done, any local irregularity should be corrected, and occasional linear or punctate cauterization of the inferior turbinated bodies will afford distinct relief.

Only experience will show what is best in any given case, as some of these preparations will benefit one and will accomplish nothing or do harm to another. All of them may be efficacious at first and later lose their effect. The physician has to watch and study each individual case and modify his therapeutics as indications arise. Some cases will be found in which nothing will do any good, and every victim of hay fever who cannot escape to an immune region must be reconciled to the fact that he must suffer some discomfort during the time the disease is prevalent.

EPISTAXIS.

The great majority of cases of nosebleed never come into the hands of the physician, as the bleeding either ceases spontaneously or responds

to some home method of treatment, which is practically the same thing. Of those which the physician is called upon to treat, some require active intervention and others do not, depending upon the cause of the hemorrhage.

When called upon to treat a bleeding nose the first essential is to ascertain the cause of the trouble, and the second is to locate the point from which the blood is exuding. If it be traumatic in origin and associated with fracture of the nasal bones or septum the application of an intranasal splint for holding the broken parts in place will usually check the trouble.

If it is vicarious and the patient of sufficient intelligence to understand the situation the bleeding may be allowed to cease of its own accord. If it is the result of an overworked heart and engorged bloodvessels it is of benign influence and should not be interfered with. If it occur in a stout, red-faced individual after exertion the same principle will apply, viz., let it alone, unless of course it lasts sufficiently long or is of such violence as to threaten acute anemia.

There still remain two groups of conditions which frequently give rise to nosebleed, viz., certain constitutional diseases, such as leukemia, pertussis, and enteric fever, and a number of local intranasal diseases. Inquiry into the general symptoms of the patient will soon settle the question of which class the individual case belongs in.

When called to attend a case of epistaxis the physician should lose no time in getting to work, inquiring as he works as to the possible causes of the condition. A glance at the bleeding nostril or nostrils, together with an appreciation of the facies of the patient, will tell whether or not the case is already a serious one. Having sized up the case in this respect, the patient's pharynx should be examined, so as to ascertain if he is bleeding posteriorly as well as anteriorly, and to what extent. It is well to take a little time in doing this, for often the blood will drop slowly from the tip of the uvula and will not be noted in a hasty examination.

The principle to be adopted in dealing with these cases is the use of such general and local methods as will most promptly check the hemorrhage with the least discomfort to the patient, the least likelihood of a recurrence, and a minimum of after treatment.

As regards general treatment, if the case is one which promises to be slight in amount and short in duration the mere causing of the patient to lie down on his side with the bleeding side up will often be all that is necessary. If it sizes up as a difficult one, either from the amount of blood already lost, from the activity of the hemorrhage, or from the nervousness of the patient, the first thing to do is to administer hypodermically a full dose of morphine. This will calm the patient and thus secure better coöperation, and by quieting him lower the rapidity and force of the heart beats. Gelatin may be given internally, as well as calcium lactate or calcium chloride.

After the hypodermic has been given, and while the physician is preparing his armamentarium, the patient's clothing around the neck and waist should be loosened and he should be made to lie down on his side with

the bleeding nostril uppermost. While lying in this position the blood can be received into towels.

When all is ready, search should be begun for the bleeding point. Examination should be deliberate and thorough, for time apparently lost in this respect is gained later by the accuracy with which local measures can be applied. Under full illumination there should be inspection of both the anterior and the posterior nares, although very little can be determined with the rhinoscopic mirror unless there is a vessel spurting into the nasopharynx. The first thing to be done to facilitate this examination is to have the patient blow the blood and clots from his nose, and if immediately afterward a quick glance be taken into the nostril the source of the hemorrhage can frequently be seen. No hesitation should be shown in having the nose blown, for the clotted contents are of no use while the bleeding is continuing, and are actually in the way both of making a diagnosis and of applying treatment. Rifle and not shotgun methods must be observed. Packing, insufflating astringent powders, injecting astringent solutions, inserting plugs of pork rind, etc., all without previously determining the point of bleeding, are therapeutic anachronisms. They may hit the mark, a matter of luck, but usually do not. One should find the bleeding point and go to it and it alone.

If the bleeding point is not visible on mere blowing of the nose the nasal chamber should be syringed with hot water, the head being held forward over a basin and the mouth kept open, and the lungs filled with air before the water is introduced. When the water comes away light pink in color, another look should be taken. If this fails to reveal the sought-for point a pledget of cotton should be soaked in a solution of 5 per cent. cocaine in 1 to 3000 adrenalin chloride solution, the excess squeezed out, and packed in the region between the middle turbinated body and the septum. A similar pledget should be packed between the inferior turbinated and the septum and the patient made to lie down in the lateral position. During this time there should be no undue hurry, and the patient should be assured of the certainty with which the bleeding will be stopped. He should have explained to him the necessity for locating the exact spot from which the blood is coming and the necessary delay in stopping it. After the pledgets have been in place for ten minutes they should be removed and the nose again cleansed. The cavity will then usually be found dilated and sufficiently clear to allow the sought-for point to be seen.

Generally all this trouble and time need not be taken, for in a majority of instances the source of the hemorrhage will be found in an area of the nasal septum about 2 cm. square and situated just behind the nostril and above the floor of the nose. If the patient's head is turned well toward the side opposite to that from which the blood is flowing, inspection of this part of the nose will be much facilitated. It is here that are found the terminal branches of the anterior palatine artery, which ramify in the mucosa after passing up through the incisive foramen. Here also are found the radicles of the accompanying vein, and from these the hemorrhage is usually derived. Among many score of hemorrhages from this

region which I have seen only one was arterial. This was a very obstinate case, the patient's life being threatened and the severity of the bleeding requiring a three weeks' stay in bed in a hospital. When the nearness of this region to the dust of the outside air is considered, along with the accessibility to the finger in removing crusts and the thinness of the mucous epithelial layer, it is readily understood why this is a favorite spot for bleeding.

Probably the most satisfactory agent for sealing a bleeding point in the nasal mucosa is chromic acid. This is applied to the greatest advantage in the form of a bead made in the following manner: A small tipped probe is well heated and dipped into a bottle of dry chromic acid crystals. Usually a crystal or two will cling to the probe, which, with the adherent crystals, is held inclined over a flame until the acid has melted and run as a drop to the end of the probe. On removing it from the flame the drop will solidify into a bead, and it is then ready for use. The bleeding area should then be dried as well as possible and the acid bead gently rubbed over it. This will usually stop the hemorrhage with great promptitude. If chromic acid is not available a bead of argentic nitrate or a 15 per cent. solution of the same salt may be used, the latter on a cotton-tipped applicator.

Should these means fail, the more brutal procedure of packing the nostril may have to be resorted to. The principle here is to close the posterior naris by drawing into it a plug of gauze through the nasopharynx and to fill the nasal cavity in every possible place by packing in a long narrow strip of gauze by means of nasal dressing forceps, or some special apparatus, such as the Darmack packer. The packing and postnasal plug should be removed not later than thirty-six hours after introduction, as longer retention endangers the integrity of the Eustachian tube and middle ear. The anterior packing should be moistened and its extraction thereby facilitated by the instillation every two hours of an oily solution, such as the following:

Phenol,									
Oil of cinnamon						55	gtt.	j	(0.06)
Liquid petrolatum (white)	.	.	.	.	.	f5j			(30.00)

A solution of hydrogen dioxide may be used for the same purpose.

At the termination of thirty-six hours the end of the gauze strip should be grasped and withdrawn from the nose and the strip pulled out very slowly, the physician stopping frequently and inspecting the interior of the nose for a recurrence of the bleeding. If there is none, the entire packing should be taken out. If oozing is seen the withdrawn portion should be cut off and the remainder packed back into place. The next day the same maneuver should be gone through, until the whole packing is removed.

After the hemorrhage is checked and the nose clear, a careful inquiry into the occupation and history of the patient should be made, and the nose studied for some chronic condition, such as ulcer, neoplasm, perforation of the septum or engorged vessels, which should receive proper attention.

Recurring Epistaxis.—One very frequent, and, in my experience, the most frequent, cause for recurring epistaxis is an engorged anterior inferior septal vein. This vessel is one of the radicles of the anterior palatine vein, and after ramifying in the anterior inferior portion of the septal mucosa it passes through the foramen of Stenson in the incisive canal. It is frequently distended on one, rarely on both sides of the nasal septum, this engorgement being more common in cases of deflected septum, such deflection favoring partial occlusion of the vein in its passage through the hard palate from the nose to the roof of the mouth. Casual inspection of the anterior part of the septum, even with the head turned toward the opposite side, will sometimes show no evidence of enlargement of the vein, but careful examination will usually show some dilatation of the main trunk near the floor of the nose. It is sometimes so thin at this situation that a mere gentle brushing with a cotton-tipped applicator will start a brisk hemorrhage. A certain method of determining the exact condition of the vein is to place tightly a pledget of cotton soaked in 1 to 1000 adrenalin chloride solution over the part of the septum in question and allow it to remain there five to ten minutes. On removal of the cotton the mucosa will be blanched and a tree-like vein will stand out darkly against the ischemic background.

The therapeutic indication here is to force the blood into competent anastomotic by-paths, and this can be accomplished very readily in the following manner: The region of mucosa enclosing the vein is anesthetized by covering it for ten minutes with a small wad of cotton containing 5 per cent. cocaine solution. After removal of the cotton the area should be wiped dry, this being done with the utmost gentleness, as a slight amount of roughness will frequently start a hemorrhage, even a careless removal of the cotton pledget sometimes causing bleeding. The main trunk of the vessel should then be destroyed by drawing through it a horizontal line with a bead of chromic acid, made as described above, care being taken to make the line below the lowest tributary of the vein. This is followed by a small slough of mucous membrane, including the vein, which is followed by a cicatrix, and the lumen of the vessel is destroyed, the blood being forced to take other channels.

This has in my experience rarely failed to cause a cessation of the nasal bleedings. Sometimes a second application of the acid has been necessary, but never more.

FOREIGN BODIES.

The removal of a foreign body from the nose is a procedure which requires careful diagnosis and considerable mechanical resourcefulness.

It should be accomplished with the least possible amount of trauma to the nasal mucosa and allied parts, as well as with a minimum of anxiety and discomfort to the patient. The requisites for a successful extraction are either full coöperation or general anesthesia of the patient, careful preparation of the nose, and conservative manipulation on the part of the physician.

Before an attempt is made to remove the offending structure it is advisable to ascertain, as far as possible, the history of the case, whether the object is mineral, vegetable, or animal, whether it entered from the anterior or posterior nares, how long it has been present, and whether any previous attempts have been made to remove it, all of these data being valuable in estimating the possibilities of the situation.

In proceeding to the actual removal the first thing is to be assured of quiet behavior on the part of the patient. This can be taken for granted in most adults, but in younger patients frequent resort must be had to a general anesthetic, chloroform being the choice.

If general anesthesia is not required the nasal chamber anterior to the foreign body should be sprayed with a warm alkaline solution and mopped clean with cotton, after which the region should be packed with pledgets of cotton soaked in the following solution:

Cocaine hydrochlorate	gr. xxiij	(1.5)
Adrenalin chloride solution	f ʒiiss	(6.0)
Normal salt solution q. s. ad	f ʒj	(30.0)

This will render insensitive the mucous membrane and also shrink it down to a minimum thickness, giving freedom of inspection and manipulation, as well as comfort to the patient. The instruments which will be found most useful are a pair of slender but strong angled forceps with serrated ends, a small spoon about 3 mm. across the bowl, a small ring curette, a wire nasal or aural snare, and a small hook, such as is used in strabismus operations. In addition there should be at hand a few small copper probes with slender tips. These are almost essential, for they can be bent into hooks and loops of a size and angle to fit the individual case, as instances often arise where the shape or character of the surface of the intruding body, its location, or the contour of the anterior of the nose render useless all ordinary instruments. Under such circumstances one is forced to improvise apparatus to meet the special requirements of the case.

Having anesthetized and contracted the nasal mucous lining, the cavity should again be cleaned and the position and character of the foreign body determined. By means of a probe the nature of its surface and its freedom of mobility should then be tested. If it is rough and jagged, the nose should be drenched with a bland oil by means of an atomizer, but if it is smooth no further preparation is needed. The following principles should be observed in the actual removal:

Everything should be done under inspection with good illumination, nothing being introduced into the nose unless under direct observation.

Under absolutely no circumstances should a stream of water be injected into the unaffected nostril for the purpose of washing the body forward and out. The force necessary to accomplish this would drive the water into the pharynx, and would also seriously menace the integrity of the tubotympanic mucosa.

If the foreign body is small it should be extracted with forceps, care being taken that the tips of the blades are passed beyond the equator of the body before they are closed.

If the forceps slip off and the substance retreats the forceps should be laid aside and a hook, spoon, ring curette, or wire loop passed beyond its widest part. It can then either be rolled out by gradual coaxing or grasped in the snare loop and withdrawn.

Only very gentle blowing of the nose is allowable to aid in the dislodgement, and this will usually be useless unless the body is in or near the inferior meatus. The higher in the nose it is situated the more tightly is it likely to be lodged and the less assistance will the expiratory stream of air be in forcing it from its position.

If the body is a pledget of cotton or gauze the forceps or hook will usually extract it, although sometimes quite prolonged search is required in order to find it, as it may get between the inferior turbinated and inner antral wall or away up in the upper meatuses.

If it happens to be a bead or button it is often possible to pass a hook through the ring or hole and thus readily effect withdrawal.

If it happens to be a piece of meat or other vomited material it may be too large or too friable to be drawn forward through the nasal passages. Under such circumstances a justifiable procedure is to wrap the end of a nasal applicator with cotton and with it push the foreign structure into the nasopharynx. This would better be done with the patient in a recumbent position, so as to prevent anything dropping into the larynx. After the structure is free in the nasopharynx it can be "hawked" into the oropharynx and expectorated.

If larvæ or other living bodies be found in the nose they should be picked out and any damage they may have done to the mucous membrane repaired by appropriate treatment.

After the nose has been freed from its intruder it should always be thoroughly examined for injury. A spray of gr. j (0.06) each of menthol and camphor to the ounce of liquid vaseline should always be used for a few days, to relieve the inevitable local irritation

DISEASES OF THE PHARYNX.

ACUTE LACUNAR TONSILLITIS.

In this disease one finds an infection of the crypts of that group of lymphoid tissue known as Waldeyer's ring, viz., the faucial, lingual, and pharyngeal tonsils. Many different drugs have been advocated in this disease and the very multiplicity is evidence of their futility. It was not until I tried the treatment outlined below that I began taking pleasure in treating this disease, for under it unquestionable results were obtained and it became possible to accomplish more than merely treating symptoms.

The first thing to do in treating a tonsil with the appearance of acute lacunar disease is to eliminate diphtheria, by examining a smear if

possible and thus saving many valuable hours, or by taking a culture and awaiting the result. One or both of these should be done in every case of acute lacunar involvement of the tonsil.

When the diagnosis is made the patient should be put to bed, ordered milk diet, and be given a thorough emptying of the bowels.

Locally, I have found nothing which will in any way equal acetylsalicylic acid (aspirin). It should be used in the following manner: The tonsils should be sprayed and swabbed clean of the glairy mucus which is so copious in the majority of these cases. For this purpose nothing is better than the official liquor antisepticus alkalinus warmed and diluted to 25 per cent. strength. The nose and nasopharynx also should be cleansed with the same solution. Then, with a cotton-tipped applicator, which has been moistened and dipped in finely powdered aspirin, the entire surface of the lingual and both faucial tonsils should be thoroughly gone over, the drug being well rubbed in. A small quantity should also be blown into the nasopharynx by means of a long tubed insufflator. If for any reason the patient cannot have the tonsils rubbed, the next best thing is to apply the aspirin to them by means of a powder blower; but this method of administration will not produce the results that will follow the rubbing in. If but one tonsil is involved, the apparently uninvolved one also should be treated; this procedure sometimes prevents the infection from developing on the unaffected side, and it will at least mitigate the course of the disease if it does develop.

This local treatment should be given every twelve hours until the spots disappear from the tonsils, which will usually be about thirty-six to forty-eight hours after the first application. The results of this method of treatment are quite marked, in that it to some extent lessens the pain at once, it shortens the course of the disease, and it usually prevents the development of complications or sequels, such as acute inflammatory rheumatism or acute endocarditis.

If the patient suffers from repeated attacks, during an interval proper surgical measures should be used to eliminate the offending tissue.

CHRONIC LACUNAR TONSILLITIS.

The situation to be dealt with in this disease consists of a narrowing or obstruction of one or more of the tonsillar crypts, with the result that the secretions and epithelium are retained and form caseous plugs, which become rancid and offensive. Sometimes the obstruction is due to a narrowing of the mouth of the crypt, and at others, and the more frequently, to the close overlying of the cryptal mouth by the plica triangularis, the anterior faucial pillar, or the soft palate. Casual examination more often than not fails to reveal the condition, and it is always necessary to retract the plica and the pillar to secure an adequate idea of the extent of the trouble.

The therapeutic indications are plain, viz., to remove the concretions and to open widely and permanently the mouths of the affected lacunæ.

To clean the crypts thoroughly sometimes requires considerable dexterity and quickness, for the process is disagreeable to the patient and, almost invariably causes gagging. Coöperation on the part of the patient is a great help, especially when the upper or anterior follicles are the ones involved, as the physician will need both hands, one for the pillar retractor and one for the instrument with which the lacuna is to be cleaned. Under these circumstances the patient will have to hold the tongue depressor, and it may be necessary to cocaine the region to be worked on before anything can be done.

For the actual removal of the cheesy accumulations, a small spoon, a ring curette, a small hook, and a flexible probe are sufficient, and with this combination any lacuna can be emptied. Not infrequently a mass will be held in place by a bridge of tonsil tissue separating the mouths of two communicating crypts. No hesitation should be felt in, by a quick jerk, tearing through such a strip of tissue, this little maneuver being sometimes all that is necessary to cause a permanent cure.

Chemical cauterants will not effect a radical cure of this condition. The mouths of the lacunæ must be made wide and free of any overlapping cover, and ablating of the offending tissue is required in all cases. No other measure will prevent the crypts from repeatedly refilling, but if the lacunar orifices are rendered wide and unobstructed a final cure will be effected.

SUPPURATIVE TONSILLITIS.

The situation met with in this disease consists of an acute infection of the tonsillar or peritonsillar tissue, with a tendency to pus formation. "There is no local disease of similar extent which so rapidly exhausts the strength of a patient." (Osler.)

The disease sometimes begins with all the appearances of an acute lacunar condition, but when the spots begin to disappear without subsidence of congestion and swelling, especially if this is limited to one side, the physician should begin to suspect the real condition.

The general treatment is that of any acute febrile disease, including putting the patient to bed, and ordering light diet and a saline laxative. Local treatment at best must be palliative, as nothing will prevent the formation of pus. Hot applications in the form of a water bag, poultice, or emplastr. kaolini, or cold by means of an ice-bag, may be used on the neck. A certain amount of relief can be afforded by the use of lozenges containing gtt. ss (0.03) of phenol, one of which is to be allowed to dissolve slowly in the mouth every two hours. Internally, morphine may be required if the pain becomes unendurable, and should be given without hesitation.

As the portal of entry of the infection is usually the supratonsillar recess, the examination of the faucial region should always include retraction of the anterior pillar and examination of the recess. If any cheesy accumulations are found, they should be removed and the lacunæ from which they come thoroughly washed out and touched up with 25 per cent. solution of argyrol.

At each visit a thorough search should be made for a fluctuating or soft spot, the presence of which would indicate that pus has formed and is ready to be evacuated. This examination must be thorough and should include direct inspection of the tonsil and anterior pillar. A location at which pus sometimes points is the angle of junction between the upper and lower gums. This place is likely to escape notice in an ordinary examination, but it should never be overlooked. In addition to direct examination the mesial surface of the tonsil should be examined by means of a throat mirror. If nothing indicating pointing can be seen, the tonsillar area should be palpated, the physician facing the patient and using his left index finger for the left tonsil and the right index for the right tonsil.

As the disease progresses it becomes increasingly difficult for the patient to open his mouth. This is a severe handicap in making an examination, and under these circumstances it is advisable to insert a closed mouth gag between the teeth and every few minutes open it a little farther. This will eventually give a maximum of room with a minimum of discomfort to the patient. If pus is present, under high tension, and near the surface, the forcible opening of the mouth in this manner will sometimes cause rupture of the abscess and allow escape of the pus.

When pus is discovered, it should be evacuated at once. By the time it is discovered, the pain, fever, and partial starvation have frequently wrecked the pluck of the patient, and the opening of the abscess should be made as painless as possible. To secure this it is best to hold successive pledgets of cotton soaked in 20 per cent. solution of cocaine against the area to be incised until sensation is gone. When the incision is made it should be free. As regards the knife to be used, my preference is for a thin sharp-pointed tenotome for the initial plunge and a blunt-pointed tenotome for enlargement of the incision. The cut should be made at the point where pus is found and should be large enough to afford free drainage. There are no bloodvessels near enough to be damaged if the knife is kept internal to the plane of the last molar tooth.

Many authorities recommend that the tonsil be incised freely, even if no pus is discoverable. With this I most emphatically disagree, for the reasons that I have never seen it afford relief, I have seen the incisions become infected, and a certain number of these cases undergo resolution without pus formation. No one incises a boil until it has pointed, and to my way of thinking it is most unscientific to jab hither and thither in the hope of finding pus. It does no good, and it frequently causes the patient to lose confidence in his physician.

The dangers of the disease are suffocation from the abscess rupturing and pouring its contents into the larynx, edema of the larynx from pressure and extension of the inflammation, rupture of a large vessel in the neck from erosion of the vessel wall, and septic thrombosis.

The danger of being drowned by escaping pus can be avoided by having the patient sleep on his side, preferably the affected side, but never on his back. In the lateral position the escaping discharge will

run into the cheek or into the lateral portion of the pharynx before invading the larynx, and sufficient warning and time will be given to allow the pus to be expectorated.

If respiration is being obstructed by edema, there should be no hesitation in doing tracheotomy. If this is done under general anesthesia, the opportunity should be taken to explore and remove the affected tonsil.

The danger of vessel erosion and septic thrombosis can be avoided only by unremitting care and attention, and by opening the abscess as soon as its presence can be determined.

If the patient suffers from recurrent attacks he should either have his tonsils removed between attacks or, if the supratonsillar fossa is deep and the seat of accumulations of secretions and detritus, enough of the upper part of the tonsil should be removed to make of the recess a wide open funnel with the apex outward. The former procedure always, and the latter usually, will prevent any further attacks.

HYPERKERATOSIS.

This condition, frequently miscalled "mycosis," is one that is usually mistreated because its true nature is not suspected or realized. Characterized, as it is, by overgrowth of the lacunar epithelium of the faucial, the lingual, and sometimes the pharyngeal tonsil, it is too often treated with solutions of such drugs as silver, iodine, tannic acid, etc., measures utterly useless in effecting a cure. Having determined definitely by means of a probe or forceps that the whitish points are firmly attached, that they extend deeply into the tonsillar lacunæ, and that the condition is chronic, the diagnosis of hyperkeratosis can be made.

The treatment, to be successful, must comprise the destruction of all of the epithelial lining of each and every affected crypt, a result which can be accomplished only by the use of a galvanocautery point. In applying this method of treatment, the particular region to be cauterized should first be anesthetized by means of successive pledgets of cotton soaked in 10 per cent. cocaine solution and held against it. Then a narrow cautery point, heated to a white heat, should be thrust into one of the white spots and carried to the bottom of the crypt. After this has been done, the electrode should be withdrawn, reinserted, and the lacuna enlarged by burning its sides until all traces of the whitish epithelial overgrowths are destroyed. When one crypt has been thoroughly treated another should be attacked, as many being corrected at each sitting as the patient can stand.

After a lapse of about four days another group can be treated similarly, until the condition is cured, but a verdict of complete cure cannot be given until examination of the throat, after a period of at least four weeks, proves that there has been no recurrence. The examination is not to be considered thorough unless the anterior faucial pillar and the plica triangularis have been drawn aside by some such instrument as Wood's pillar retractor, and the area of tonsil covered by them thoroughly inspected.

At times the cautery has to be sunk very deeply, 1 cm. or more, into the tonsil in order to reach the bottom of the crypt, and it is in such cases as these that there is likely to be a quick recurrence, for it is difficult to include every bit of the cryptal lining in the first cauterizing. Persistence in the use of the galvanocautery, special care being taken to widen the more obstinate lacunæ, will inevitably meet with permanent success. When the hyperplastic lining of the crypts has been completely and thoroughly destroyed, the disease does not recur, although it may develop in other crypts which showed no involvement at the time that the first ones were treated.

DISEASES OF THE LARYNX.

ACUTE CATARRHAL LARYNGITIS.

This affection is always annoying, and in those who earn their living by the voice, such as actors, singers, teachers, salespeople, etc., it is a calamity. The inconvenience attending it, while out of all proportion to its gravity, is usually so great that every means should be used to restore the larynx and especially the voice to normal.

The general treatment of the disease is the same in principle and practice as that of an acute rhinitis (see page 377). In addition to the measures there indicated, the attending cough may require interference, this being true only of the early days of the disease when the cough is dry, irritative, and unproductive of sputum. To allow the cough to continue under such circumstances does considerable harm, since the sudden opening of the glottis and the jarring of the larynx during each act of coughing help to aggravate the local inflammation. To regulate this condition, a single full dose of gr. $\frac{1}{6}$ (0.01) of morphine sulphate is often efficacious. This may be followed the next day, at three-hour intervals, by gr. $\frac{1}{6}$ (0.01) of codeine sulphate, gr. $\frac{1}{16}$ (0.004) of heroin, or m xxx (2.0) of tinct. opii. camphorat. When the cough becomes loose the use of such drugs as these should be stopped. If the condition is rheumatic, the proper medication should be used.

Locally, the most important thing to do is to insist on absolute vocal rest; even whispering had better be avoided. One is often appealed to to give temporary relief, mainly by those who wish to make some public appearance, but there is no quick or royal road to cure. Any measures which would give temporary relief to the larynx would in the end do harm, since the use of the voice under such circumstances would prolong convalescence and perhaps result in a chronic laryngitis being set up. It should be impressed upon the patient that to lose time in the beginning is to gain it in the end.

Gargles will do no good, for they cannot get into the larynx. If hot water is their basis, the mere presence of the heated solution may afford some ease, but there are better ways of attaining this result. The inhalation of warm moist air from steaming water to which may be added

compound tincture of benzoin in the proportion of m xxx (2.0) to Oj (5000) will help to relieve the condition. This should always be followed by the patient remaining indoors in a warm room for at least half an hour.

External applications of heat and cold may be of use, decision as to which should be used depending upon which is the more agreeable to the patient. Counterirritation by means of tincture of iodine may be used on the skin over the larynx.

The hourly use of a mild spray of *liq. petrolat. alb.* I have found to be of distinct value in giving comfort to patients. The main dependence is the oil, but to each ounce may be added menthol, gr. j (0.06), camphor, gr. j (0.06), phenol, gtt. j (0.06), or *ol. pini sylvestr.*, gtt. ij (0.12). If these produce the slightest amount of irritation the oil alone should be used. The nose should be included in using the spray, for it is highly important that the patient breathe through the nose, so as to avoid drawing cold, dry, and dirty air into the larynx. A lozenge containing gtt. j (0.06) of phenol may be allowed to dissolve in the mouth at three-hour intervals.

While there is some discussion as to whether or not topical applications to the larynx are of any value, my experience leads me to believe that some are. Powders should be avoided, as the amount of cough they cause counterbalances any good they might accomplish. My standby in acute laryngitis is argyrol in 25 per cent. solution, freshly dissolved. The local routine I observe in a case of acute laryngitis is first to cleanse the nose with a warm alkaline solution, such as 25 per cent. *liq. alkal. antisepticus*, after which the pharynx is sprayed with the same solution. Then with a laryngeal syringe, and under observation with a laryngeal mirror, gtt. iij (0.18) to gtt. v (0.3) of 25 per cent. argyrol solution is dropped on the laryngeal surface of the epiglottis and allowed to run down into the interior of the larynx. Just before the drops are instilled the patient is told to say "A," the utterance of which throws the epiglottis forward and closes the glottis. The former opens the larynx for medication, and the latter closes off the trachea, a most necessary procedure, for the entrance of a solution into the trachea usually causes prolonged and most distressing coughing. As soon as the argyrol is dropped into the larynx the patient is told to swallow, with the result that there is no discomfort attending the presence of the drug. Relief to some extent is experienced at once, and the daily use of the procedure as just described will soon restore the larynx to normal. Use of the voice should be resumed gradually, and at this time, especially if the patient is a singer, the method of voice and tone production should be studied. If there are any bad habits along this line they should be corrected and thus render the individual less susceptible to future attacks.

EDEMA OF THE LARYNX.

In treating this disease it is most essential to discover the underlying cause and treat that. The heart and kidneys should receive special atten-

tion, and if the laryngeal condition is secondary the proper remedial measures should be directed toward a restoration to normal of the primarily diseased organ. Sometimes there is no discoverable cause, and the physician's attention has to be confined to the local disease, the treatment depending on the gravity of the situation at the time the patient is first seen.

If the case is an early one and is seen before urgent dyspnea presents itself, much can be done to prevent the development of this sinister symptom. The larynx should first be examined carefully in order to locate with definiteness the situation and extent of the infiltrated tissue. This having been determined, the patient should be put to bed and given three doses of concentrated magnesium sulphate solution at fifteen-minute intervals, each dose being a rounded teaspoonful of the salt in as little water as will dissolve it. In this way several copious watery stools can be produced, which will aid in reducing the edema. For use in the throat, nothing equals the solution of adrenalin chloride, gtt. iij (0.18) to gtt. v (0.3) of which in a strength of 1 to 3000 watery solution can be instilled by the attending physician into the larynx, and which, in the form of adrenalin inhalant, should be sprayed and inhaled into the larynx every two hours.

A fly blister applied to the cervical integument over the edematous area and allowed to remain for about two hours seems to aid in absorbing the transuded fluid.

If dyspnea is, or threatens to be, urgent, the infiltrated tissue should be freely scarified and punctured. This cannot be done without special instruments and without preparation of the patient. He should be given a hypodermic of gr. $\frac{1}{6}$ (0.01) of morphine sulphate, and the larynx should be anesthetized by instilling a few drops of 10 per cent. cocaine solution, this being repeated until the laryngeal mucosa is insensitive. Incisions should be made into the swollen tissue with great freedom, for while they seem and are deep, this is true only until the tissue returns to normal.

If obstruction threatens life, air must be admitted either by intubation or tracheotomy, the choice depending on the cause, extent, and location of the swelling, the age of the patient, and the facilities at hand. It is very hard to state exactly the time when one of these procedures should be adopted, for some cases with marked dyspnea and stridor recover without the use of measures other than those mentioned above, while others with but slight interference with the ingress and egress of air suddenly grow much worse. Only experience and a careful analysis of each individual case can keep one near the right tract, but even then one will sometimes go wrong. Perhaps the safest principle is "delay is dangerous."

TUBERCULOSIS OF THE LARYNX.

Tuberculous disease in the larynx is so protean in its manifestations that many therapeutic indications have to be met. While in the major-

ity of cases the treatment need consist of no more than the patient is receiving for his pulmonary condition (see Landis' Article, vol. i, p. 739), in a considerable number local treatment is required. What can be, and is accomplished by local measures is to influence favorably almost all the early cases, cure a great many of the later ones if the patient shows good general resisting power, and relieve, to a greater or less extent, the awful suffering caused by some of the terminal manifestations of incurable disease.

When a tuberculous patient's voice grows husky, or he complains of an ache or pain in his throat, or has a cough out of proportion to the amount of expectoration, his larynx should receive a careful examination. The local condition should be accurately diagnosticated and the general nutrition of the patient carefully estimated, and on the correlation of these two should the treatment be based. The scope of this article is so limited that the various special procedures which need to be adapted to varying forms of the disease cannot be fully entered into, and it is possible to discuss only in a broad way the available therapeutic measures and the general indications for their use.

Tuberculosis of the larynx necessitates *imprimis* that the patient be given the same general treatment that tuberculous involvement of the lungs would cause him to receive. Its purpose is to arrest the disease by building up nutrition so as to check further advance of the trouble and to cause a fibrosis in any existing lesion. To this end, anyone with his larynx affected should have all the advantages of the best present-day factors of treatment, in the way of diet, fresh air, etc.

To combat directly the laryngeal lesion, we have as available therapeutic measures rest, counterirritation, sprays, lozenges, local applications, specific therapy, the galvanocautery, and various surgical procedures.

By rest is meant vocal rest, a measure in vogue for some years in the Continental and later in the British sanatoria. Broadly speaking, the practice is a sound one, for one of the earliest and best recognized medical principles is the enforcement of non-use of an inflamed structure. This applies with peculiar force to the larynx, since every spoken word necessitates the contraction of several laryngeal muscles, movement in the crico-arytenoid joints, and vibration of the vocal cords and entire larynx. When one considers the fact that laryngeal tubercle most frequently manifests itself in the interarytenoid space, a region which is compressed at each approximation of the cords, the imperativeness of putting the larynx at rest should be obvious.

Rest of the voice is usually rebelled against by the patient, unless there is pain in the larynx, but a full explanation of the rationale of the advice usually reconciles him to it. Sometimes one has to be satisfied with the patient confining himself to whispering, but to allow even this is not advisable. Complete silence, communication with others being effected through the medium of pad and pencil, is what should be aimed at.

After healing and cicatrization have been secured, the use of the voice may be resumed in the same way that general exercise is allowed. The patient may start, for example, with ten minutes' conversation a

day, increasing this allowance from five to ten minutes every third day until full use of the voice is restored.

There is one form of the disease in which unlimited use of the voice is advisable, this being the variety in which the vocal cords are the only parts of the larynx involved. This is commonly called the "chorditic" form, the cords appearing slightly congested and having on their upper, and to a slight extent on their mesial, aspect a number of reddish granular growths. These are possibly sometimes submucous tubercles, but more frequently are distended mucous glands with their duct orifices occluded. Vocal exercise aids in clearing up the condition, and it is in this form that improvement of the voice so frequently follows an acute coryza.

Counterirritation I use frequently in two forms—blisters and cold applications.

Why blisters help a tuberculous larynx is hard to explain, but after an experience of using them in many hundreds of cases, I am convinced that they are of distinct value. The best result is obtained from their use in cases characterized by considerable congestion. Where the larynx is pale or the lesion is hyperplastic in character, such as the papillomatous excrescences seen most frequently in the posterior commissure, they seem to be of no value. In ordering them, a good cantharidal plaster two inches square is prescribed, and the patient is told to cut this into four equal parts, and each of the four into equal fourths, making in all sixteen little plasters, each a half-inch square. The patient is then instructed to put one of these on a spot on the side of the neck in the area bounded by the hyoid bone, the cricoid cartilage, and the anterior margins of the sternomastoid muscles. It should remain in place for from one to two hours, depending on the toughness of the skin and the excellence of the plaster, after which it should be removed and the blister dressed with cold cream or zinc ointment. The next day another plaster is applied, but on the opposite side of the neck, every day a fresh blister being formed on alternating sides. This is continued as long as the condition of the throat demands it.

These blisters often give distinct relief and comfort, and I have had many patients who have once used them and had them discontinued ask to be allowed to resume their use. The stain they produce in the cervical integument usually entirely disappears.

Cold applications are of distinct value in those cases characterized by tickling and a dry, irritative cough, particularly on lying down. Such patients are told to use iced compresses to the neck for from fifteen to thirty minutes after going to bed. The result, except in those who are very weak and in the terminal stage of the disease, is almost always a distinct amelioration of the symptoms complained of.

Sprays of only one character are of any value, viz., those of the oily variety. They are the only ones that can be used by patient or nurse, and while I do not believe that they are of much direct curative value, yet they have a distinct place in treating the disease. The essentials for a laryngeal oil spray are that the oil is thin and easily converted into a

spray, that it is bland and non-irritating, and that it is agreeable in taste and odor. I usually order a spray containing gr. j (0.06) of menthol and camphor to f3j (30.0) of liq. petrolat. alb. The best value is obtained in those cases in which the sputum tends to gather in and become adherent to the laryngeal interior. Frequent spraying with an oil such as the one just mentioned will tend to lubricate the larynx and soften the scabs, thus allowing of their more ready expectoration and tending to prevent their subsequent formation.

Lozenges are of value for two purposes, viz., to lubricate the throat and thus prevent dryness, especially at night, and to render swallowing more easy in the late extensive and incurable forms of the disease. In ordering lozenges great care should be exercised that no anorexia or gastric disturbance is caused by their use. To have a tuberculous patient lose his desire or capacity for taking food is indeed a calamity.

The lozenge for lubricating purposes depends for its action more on the base than on the other ingredients. The best materials from the base standpoint are fruit paste and the glycerogelatin base of the *British Pharmacopæia*, the latter being useful where slow solution and prolonged action are desired. To it may be added gtt. $\frac{1}{2}$ (0.02) of phenol, gr. $\frac{1}{6}$ (0.01) of menthol, a drop of lemon juice or any pleasant flavoring extract agreeable to the patient. Other useful lozenges of the same character are those made of licorice or of slippery elm bark.

For the relief of pain, more active ingredients are required. The same bases may be used, and to them can be added gtt. j (0.06) of phenol, gr. j (0.06) of orthoform, gr. j (0.06) of anesthesin, or gr. $\frac{1}{6}$ to gr. ss (0.01 to 0.03) of cocaine hydrochlorate, the choice depending on the severity of the pain. One of these should be placed in the mouth and allowed to dissolve about fifteen minutes before attempting to take nourishment. If edema is present in the larynx, gr. j to gr. ij (0.06 to 0.12) of suprarenal extract may be added to the formula.

When dysphagia becomes extreme it is sometimes easier for the patient to swallow liquid food if he lies prone, with his head slightly flexed, and takes his nourishment through a tube. Another suggested aid is to have someone stand behind the sitting patient and "fix" the larynx by making firm downward and forward pressure with the tips of his fingers.

Many different drugs have been recommended for local use in the larynx, some of them being lactic acid, formalin, protargol, creosote, guaiacol, and iodoform. Lactic acid has been the most popular of these, but after lengthy trial I have given it up; the other drugs mentioned I have not tried. My dependence is upon argyrol and methylene blue, the former for the more superficial erosions and the latter for the deeper ones. Where the mucous membrane is unbroken, none of the drugs mentioned do any good.

Argyrol I use in 25 to 30 per cent. solution, freshly dissolved, and I instil it into the larynx by means of the Keyes-Ultzman urethral syringe, allowing from gtt. iij to gtt. v (0.18 to 0.3) to run into the laryngeal interior while the patient is saying "A." If the patient is told to swallow

immediately after the solution is dropped in, the excess will go down the esophagus and none will enter the trachea, an accident always to be avoided, as it causes severe coughing.

Methylene blue is used in 1 to 2 per cent. solution and is applied in the same manner. I have not found it necessary to use the "rubbing-in" process so insisted upon by some writers, mainly because I do not use any drugs in the larynx unless the ulcers are not covered with sloughing tissue or until such tissue is removed by cauterization.

Specific therapy is discussed elsewhere (see Pottenger's article, vol. i, p. 573). My own feeling as regards tuberculin in its many forms is that its case is not proved. Where so much depends on the psychology of patient and physician, on the condition of the cardiovascular, alimentary, and excreting apparatuses, and on the hereditary tendencies and environmental factors influencing the patient, the question is one on which it is exceedingly difficult to pass judgment. There is one very interesting point in this connection, and that is the ease with which reaction following tuberculin injections can be observed in the larynx.

The galvanocautery is the most valuable single measure we have for use in this disease. In my hands it has supplanted entirely such escharotics as lactic and carbolic acids. Its uses are three—the destruction of sluggish and sloughing tissue at the base of an ulcer, the burning away of papillomatous excrescences, and the shrinking of growths and infiltrations by puncture.

Its use for any of these purposes should always be preceded by anesthetizing the laryngeal interior with a 10 per cent. cocaine solution, about gtt. iij (0.18) of which should be dropped down the epiglottis every few minutes until anesthesia is complete. In using the hot electrode in the larynx it is usually necessary to burn a little at a time, repeating the procedure until the desired amount has been accomplished or the tolerance of the patient is at an end. The amount of burning that the larynx will endure without subsequent serious reaction is quite noteworthy. Following the cauterizing strict silence should be enjoined for several days, soft and preferably cold food should be taken, and the patient should spray his larynx hourly with a bland oil.

I have been astonished and delighted at the prompt shrinkage which has followed the introduction of a white-hot cautery point, as first recommended by Grünwald, into a tuberculous swelling. The point is sunk into the full depth of the growth in one, two, or three places at a sitting. Following the burns, sloughs form, which are later thrown off and replaced by cicatrices. Quite large arytenoids can be reduced to almost normal and swollen ventricular bands brought down to their original size. I have used this method in over twenty cases, and it has not failed to produce a good result in a single instance. To be ultimately successful the general condition of the patient must be favorable, for naturally the larynx cannot get well if the patient dies.

Other matters which will arise and require decision concern the use of tobacco, the character of food to be taken, and the use of opiates.

The question as to whether or not tobacco can be used with safety

often arises. Each case will have to be decided on its merits, but there are certain general principles which should be observed. The chewing of tobacco should invariably be prohibited, as the salivary solution of tobacco will necessarily come into close and frequent contact with the larynx. When a patient asks to be allowed to smoke, I ascertain how great a smoker he has been, whether he has been accustomed to pipe, cigar, or cigarette, whether or not he inhales the smoke, and how much nervousness and distress would be caused by his abstaining. These data having been obtained and a favorable decision having been reached, permission is granted on the following conditions, viz., that the smoke is not blown through the nose or inhaled, that only the first half of a pipeful, cigar, or cigarette is smoked and the rest thrown away, that if a cigar or cigarette is used it shall be smoked in a holder at least four inches long, and, finally that the smoking be done in the open air. The main evils, barring excess, are the dry heat and dust which are drawn into the pharynx and larynx. This is of greater significance the shorter the smoked article grows, and if the cigar or cigarette is used in a holder and only the first half smoked, this evil is largely done away with. My belief is that with such precautions as just mentioned and with the smoking done in the open air, no harm will result. A non-smoking patient in a close room with others smoking is at a greater disadvantage than one who is smoking in the fresh air.

The taking of food resolves itself into what is least irritating and most readily swallowed, and at the same time contains the nourishment most assimilable in the most concentrated form. This question appears only when dysphagia or odyphagia causes it to arise. Patients should be allowed their food in the form in which they can most easily swallow it. Some choose liquid, others solid food, but in the majority of cases semisolid food is the preference. It should not be too hot or too highly seasoned, and should be administered in small quantities at frequent intervals. Among useful articles of this character are cooked cereals with cream, thick soups, junket, fruit and meat jellies, ice-cream, creamed and crushed sweetbreads, and raw or soft-cooked eggs. Barwell recommends two ounces of minced raw beef, freed from fat and gristle, and mixed with the yolk of an egg.

Opiates, particularly the preparations of opium, should be withheld until a fatal outcome of the disease is inevitable, but when this is obvious, and the patient is suffering excruciatingly, I believe in giving enough of the drug to render the last days of the patient free from agony. It is only what humanity demands, and in addition it is what any physician in the same situation would prescribe for himself. It may possibly be claimed that this procedure will shorten the duration of the patient's life; but my experience inclines me to think that the contrary is the case, and that the extreme distress and partial starvation caused by advanced laryngeal tuberculosis will shorten a patient's span of life more than will dragging him to the point of physical and mental comfort.

The operative measures that can be used in this disease are many and valuable, but are beyond the scope of this article.

ASTHMA. ACUTE AND CHRONIC BRONCHITIS WHOOPIING COUGH

By ARTHUR NEWLIN, M.D.

ASTHMA.

THERE are few diseases in which any routine line of treatment is less to be depended upon than in asthma. The etiological factors are so various that no prophylactic rules can be applied to any series of cases with the hope of an equal measure of success in them all.

Two problems present themselves to the physician in the consideration of his patient's welfare, first to terminate the paroxysm, if he is suffering from one, the second to eliminate as far as possible the etiological factors in his case, and by so doing diminish the number, frequency, and violence of his attacks or banish them entirely.

Although the discussion of the etiology of this condition is not intended to be a part of this article, yet, aside from the theories that have been advanced as solutions of the problem of the actual cause of the disease, there are numerous etiological factors that must be considered, as they play an important part in the prophylaxis and treatment of asthma.

The views of authorities on the subject of the exciting cause of the paroxysms are somewhat at variance, the two most important being: (1) That the respiratory difficulty is due to a spasm of the circular muscle fibers of the bronchial tubes; (2) that the mucous membrane of the bronchial tree becomes swollen and hyperemic. Both of these conditions probably are present in many cases, the morbid changes being brought about by any reflex irritation of the terminal branches of the vagus nerve, the irritant operating in the respiratory or gastro-intestinal tract. That the disease is very real and painful to the victim cannot be denied, but that the cause of an individual attack is at times so trivial as to appear almost imaginary is also true; and it is only by careful attention to the apparently trifling details that the disease is successfully combated. These causes may operate through the nasal apparatus, through the asthmatic areas, or through the gastro-intestinal tract. At times the paroxysm seemingly arises as a pure neurosis. The cause of an attack of asthma is usually peculiar to the individual affected, and he, in the fulness of his experience, learns to formulate his own code and regulates his life accordingly. I have under my care a chauffeur, a man of unusually robust appearance, who can drive his car in all kinds of inclement weather with impunity, but who wishes to give up an advantageous position rather than risk an asthmatic paroxysm from washing his machine with a hose; from a like fear this same individual will not sleep

or stay in a house that is warmed by furnace heat, and I have seen him develop an attack, with asthmatic rales and dyspnea, while waiting in my office; these soon disappeared when he breathed the outside atmosphere. The exciting factors were perfectly well known to him, and he exercised great care in his prophylaxis.

It is well known that just as in hay fever the inhalation of the pollen of certain flowers, as the golden rod, will precipitate an attack, so also there are certain smells or wind-borne particles that are provocative of asthmatic attacks in some individuals. The emanations of various animals will provoke attacks in certain subjects of the disease. There are those who cannot drive or ride, as the smell of the horse precipitates an asthmatic paroxysm. I know a physician who can develop an attack which will last several hours by a few minutes' loitering in a laboratory in the vicinity of guinea-pigs.

Again, there is a class of asthmatics in which the condition is developed as the result of some indiscretion in diet; in one the food factor may be lobster, which another may eat with impunity. That "one man's meat is another man's poison," may truthfully be said to be an axiom for asthmatics. In view of these facts, then, it is of the greatest importance to the physician and his patient that the former should secure a careful and exhaustive history of the case. The patient's past and family history should be thoroughly gone over and his experience with drugs, climate, bathing, food, and so forth should become the knowledge of his examiner. This accomplished, much useless or harmful advice is avoided.

In the selection of suitable surroundings much may be done for the patient who can change his environment at will. Some will escape an attack by removal to another clime; indeed, there are few who, by the aid of an appropriate climate, cannot become, finally, entirely free from the malady. A yearly trip to Europe for a month or six weeks, even the voyage across the ocean and back, is in some cases often sufficient. A sojourn in California is of great benefit to others. There is no locality, however, that is suitable to all, and no climate can be definitely recommended with assurance of immunity. Many patients do better in the city than elsewhere, the lack of foliage and plant life probably accounting for their immunity. That a certain locality that has long been a sanctuary can suddenly become dangerous was experienced in the case of a gentleman I saw during a hot August in the city. He had frequently escaped attacks by a temporary urban residence, but on this occasion the city, where he had come with assurance of immunity, afforded him as severe a paroxysm as he had ever had out of it. To the less well-to-do, who are obliged to fight the disease at home, the effort must be made to bring them into such condition that they can withstand the environment in which they are forced to live.

The food factor is an important one and should receive careful attention. Indiscretion in eating is a frequent cause of asthmatic seizures; in such cases there may be an auto-intoxication from absorption through the intestinal canal, or a reflex irritation from the presence of certain

foodstuffs in the stomach or intestines. The dietary should be carefully arranged with the avoidance of such articles that experience has shown to be harmful. Generally speaking, the patient should select such foods as are nutritious but easily digested. Starches and carbohydrates are usually to be avoided, while meats and fat are allowable in moderation. Highly spiced food, rich sauces, game, liver, and sweetbreads should be avoided by the gouty. In addition to the selection of a proper dietary, the dangers of gourmandizing, of rapid eating, irregular hours for meals, late suppers, and so forth, should be emphasized. The bowels should be regulated by saline laxatives taken in the morning. Alcohol is usually interdicted, although it may be useful during the paroxysm. In the neurotic, all stimulating beverages, such as tea, coffee, and alcohol, should be forbidden, and under this head the danger of proprietary "nervine" medicines, on account of their usual alcoholic or opiate contents, if for no other reason, should be pointed out.

It is well to lay down for the patient some general rules of hygiene, with special instructions to suit his individual case. Bathing, cold spinal douches in the morning, followed by friction, moderate exercise at least two hours after eating, with massage and rest as adjuncts to the treatment, are advisable. The patient should receive a careful physical examination, including an examination of the nose and throat by a specialist; the presence of polypi, nasal spurs, chronic rhinitis, or any condition that causes congestion or inflammation of the upper air passages should be corrected, as asthmatic paroxysms may be induced by any of the above conditions, and the cure of the condition must necessarily be difficult while such abnormalities exist. Chronic bronchitis, if present, should receive appropriate treatment. The collection and examination of a twenty-four-hour specimen of urine should not be omitted in any case, and if there is any suggestion of an intestinal origin of the attacks an examination of the stools should be made.

In many of these cases dilatation of the heart occurs during the attack, and remedial measures may be directed toward the support of that organ; these may be applied with more effectiveness if a knowledge of the cardiac condition between attacks has been obtained. Calisthenic exercises performed with regularity are of undoubted value to most of these patients, and should be carried out systematically. Wooden dumb-bells and light Indian clubs may be employed, and by their judicious use the respiratory muscles are strengthened, the capacity of the chest increased, and the general circulation improved. Breathing exercises may be made a part of this routine, and are best carried out in the morning on first rising. The patient will be less bored and more industrious if he stands before a mirror and watches the reflection of his efforts. A cold tub bath and rub down should be taken after exercising.

To summarize, then, we have a number of measures other than drugs which may be used before the latter are considered. The diet, hygiene, climatic influences, the influence of various external factors, such as odors, emanations from animals, etc., the condition of the respiratory

tract and correction of abnormalities of the same, and morbid changes in other of the internal organs, should all receive attention in the treatment of the asthmatic patient.

Of all the drugs that have been lauded in the treatment of this condition, the most universally used between the paroxysms is potassium iodide. This drug is of value especially in those cases that have a gouty diathesis as an etiological factor, but should be used with care when the paroxysms are of gastric origin. Potassium iodide easily deranges the stomach, and many individuals have a peculiar and extremely sensitive idiosyncrasy for the drug. It is best given in small doses, well diluted, immediately after meals. I usually order a saturated solution, of which 5 drops in a half-glass of water or milk may be taken thrice daily after meals. There is no advantage in giving large doses. It may also be given in the compound syrup of sarsaparilla, a dessertspoonful of the syrup acting as a palatable vehicle. In small doses the iodide moistens the bronchial secretion. If the potassium iodide is not well borne, or if the drug, as is often necessary, is given for any length of time, sodium iodide may be substituted in the same dosage. Arsenic, best in the form of liquor potassii arsenitis (Fowler's solution), is also frequently used and may advantageously be administered in conjunction with the iodide. Three drops of Fowler's solution three times a day with potassium iodide after meals is an excellent combination. In anemic individuals the arsenic trioxide, gr. $\frac{1}{16}$, with mass. ferri carbonatis, gr. v, can be given in capsules three or four times a day. Digitalis or strophanthus are useful in those cases of asthma where there is cardiac weakness, and, in combination with nitroglycerin or sodium nitrite, are effective drugs. The effect of the last two medicaments should be carefully watched and manometric readings of the blood pressure made at frequent intervals. Tincture of digitalis, $\text{m}\times$, with sodium nitrite, gr. j, in capsules, should be administered three or four times a day. Tincture of nux vomica, in small and frequent doses, is advised by Musser. The various tonics are useful adjuncts, and should be used as indicated by the condition of the patient; cod-liver oil, iron, strychnine, and the hypophosphites are of help in individual cases. Electricity is of doubtful value, but in combination with hydrotherapy and massage may be helpful in sustaining a neurotic patient.

The Attack.—In the treatment of the paroxysm of asthma there are numerous conditions that will have a strong bearing on the method of procedure. In the first place a previous knowledge of the patient is of the greatest value, for then the physician is on familiar ground, as he knows what drugs have proved of value in former attacks, and, armed with the knowledge of his patient's idiosyncrasies, can apply his remedial measures with confidence. If, on the other hand, he is brought face to face with an individual whose physical and mental characteristics are an unknown quantity to him, and whose condition of intense dyspnea precludes the possibility of obtaining information concisely, he is thrown upon the resources of theory and empiricism. To make a careful and profitable physical examination of a person who is in the midst of a severe paroxysm,

who may be wildly excited and straining for every breath, is almost useless.

The treatment of the attack will also depend greatly on its character, whether it be mild or severe, a primary paroxysm or one of many such, if it be in a weak neurotic person or in a well-balanced, sturdy individual. The existence of other morbid conditions that must be reckoned with will also determine the course of the proceedings.

The patient usually assumes the attitude that is most comfortable to him, and should not be urged to change it. If the room is poorly ventilated the atmosphere should be improved by the admission of plenty of fresh air. The first drug that is thought of, and the one that is almost universally efficacious, is morphine. If the attack is in full swing and the dyspnea marked, a hypodermic injection of morphine is the best remedial measure known. The danger of forming the habit under such circumstances is much less than if the drug were given earlier in the attack. If the patient is a strong man, and especially one who is known to lead a busy life, it may be given with little risk. In the feeble, in idle or neurotic men or women, it is dangerous and should be avoided. The initial dose should be from gr. $\frac{1}{6}$ to gr. $\frac{1}{4}$, and this may be repeated at the end of two or three hours if necessary. The sedative action of the drug, by reducing reflex nervous irritability, serves to calm the patient, and by diminishing the dyspnea lessens the resistance to the work of the cardiac muscle. Combined with morphine, or if that drug is contra-indicated given alone by hypodermic injection, atropine stands next in the order of efficiency. The usefulness of this drug depends on its depressing influence on the terminal filaments of the vagus nerve, both bronchial secretion and reflex excitability being diminished by its administration. When combined with morphine hypodermically, it may be given in the dose of gr. $\frac{1}{100}$, with gr. $\frac{1}{6}$ or $\frac{1}{4}$ of the latter, or it may be used in the same dosage alone.

With the admission of fresh air and the hypodermic injection of morphine and atropine the effort to improve the patient's condition should temporarily cease. A sinapism may, however, be applied to the chest, in the form of a turpentine stupe or a home-made mustard poultice, and, if it can be done without disturbing the patient, a hot foot bath containing a tablespoonful of mustard should be given. The patient is then allowed to get all the advantage possible from the hypodermic injection; the room should be quiet, with as few attendants as are compatible with his care. If at the end of two hours there is no improvement, and the struggle for breath has in no way diminished, the hypodermic injection may be repeated; if, however, there is noticed an easier respiratory excursion, and the patient seems calmer, the following mixture should be prescribed:

R—Tr. lobeliæ	mx
Tr. belladonnæ	mx
Syrup prun. virg.	q. s. f ʒj—M.

Sig.—A teaspoonful given in water every three hours for four doses, and then one-half that dose at like intervals.

At this time the patient will also be benefited by inhalations of steaming water. A croup kettle containing water with a teaspoonful of compound tincture of benzoin may be placed beside the bed so that the steam is inhaled by the patient while he lies on one side with his head propped up by pillows. The medication of steam inhalations I believe to be of but secondary importance, and without the addition of benzoin the use of steam from simple boiling water is almost as efficacious. There is, however, some advantage from the use of benzoin, as the inhalations are pleasanter to some individuals, and the fact that the patient feels he is getting a special form of medication often produces a favorable mental effect. Inhalations of amyl nitrite may be tried, the pearls being broken in a handkerchief, or a dram of the drug dispensed in a small phial of cotton may be held to the nostrils.

Dover's powder in doses of gr. iij every four hours may be more efficacious than the belladonna and lobelia mixture. As the patient becomes less violently affected, other drugs may be used. If the blood pressure is high, nitrite of sodium in 1 grain doses four times a day, or spirits of glonoin, 1 drop every three hours, is indicated. If there is cardiac distress, strychnine, gr. $\frac{1}{40}$, should be given hypodermically every four hours. If there is sleeplessness, the bromides are useful and can be given freely; they are also useful if the patient is neurotic and excitable. Chloral is also an excellent drug to allay the nervousness and insomnia that are so frequently part of these attacks.

Heroin has been lauded as a substitute for morphine, and may be given by mouth or hypodermically. It has few advantages over morphine, and is not nearly so reliable a drug as the latter. Codeine is preferable to morphine when given by mouth, and in the milder attacks a half-grain of codeine given early in the paroxysm and smaller doses at three-hour intervals, may induce sleep and relieve the dyspnea. The use of adrenalin to control the paroxysms has come into vogue in the last few years. It should be used in a solution of 1 to 1000 and given hypodermically. As a substitute for morphine or atropine it sometimes seems to have an almost magical effect. From 5 to 10 minims are given subcutaneously. Von Jaglic advises its use, and Melland reports a series of cases in which it was most efficacious, the latter author believing that the drug acts by relaxing the spasm of the circular muscle fibers of the bronchial tubes.

If the onset of the attack is not abrupt, the condition developing gradually, the use of morphine is not advisable, and it is better to resort to other remedies, such as belladonna, stramonium, lobelia, or nuxvomica. Under these conditions the inhalations of the fumes of various drugs are sometimes helpful.

The use of asthma cigarettes, made of the leaves of belladonna, stramonium, or tobacco, is frequently resorted to. Cigarettes made of nitre paper smoked by the patient, or a taper of the same material lighted and held so that the fumes may be inhaled, often give relief. Hare gives the following as a good combination for the making of cigarettes:

R—Fol. belladonnæ	gr. vj
Fol. hyoscyami	gr. iij
Fol. stramonii	gr. iij
Ext. opii	gr. ʒ
Aqua laurocerasi	q. s.—M.

Smoking of ordinary tobacco is helpful to some patients, especially to those who are not particularly addicted to the habit. Inhalations of oxygen may be tried, and sometimes seem to afford relief, probably as much from the distraction of the patient's attention as from the inhalation itself. Breathing of compressed air has been recommended, but requires especial apparatus for carrying out the procedure.

With the subsidence of the acute symptoms and when the patient has overcome to a great extent his dyspnea, but whose chest still reveals by auscultation the typical wheezing rales, the above drugs may be discontinued and tincture of nux vomica, in doses of mv , every four hours, should be prescribed; then when convalescence is well established the procedures mentioned under prophylaxis should be instituted. It can be easily seen that the above treatment must necessarily be subject to variations. Complications have to be reckoned with and the personal equation measured. Cardiac weakness should receive strong supportive measures, digitalis, strophanthus, and strychnine being reliable drugs in such cases. Alcohol in the form of whisky given as hot toddy is also useful. Renal complications may make the continued use of opium or belladonna inadvisable. The paroxysms may be of such severity that a few whiffs of chloroform are necessary to control them.

There have been numerous reports of cases of asthma cured by the injection of antidiphtheritic serum, and for a while this method was quite widely employed. Coincident, however, with its more general use, many cases of sudden prostration and numerous deaths immediately following its administration were published, and today not only is it seldom employed in asthma, but even in diphtheria, where the patient is known to be of an asthmatic tendency, the antitoxin is given with the greatest care. As a cure for asthma it is certainly a most dangerous agent, and should be abandoned.

BRONCHITIS, ACUTE AND CHRONIC

One has but to consider the great diversity of classifications of bronchitis to realize how wide a field for therapeutic effort the disease presents. Not only are there many varieties of bronchitis, but the etiology of the disease also embraces almost innumerable factors. In looking over the more elaborate treatises on the subject, one is immediately impressed with the lack of uniformity of method in the classification of the disease.

From a practical standpoint the etiological factor is a most important one, as success in the treatment of the patient with bronchitis must depend on an accurate estimation of the definite cause of the variety of the disease which he presents. The treatment to be pursued in the

individual case depends not alone on the amount of cough or expectoration, not on the presence of dry or moist rales, but upon the underlying cause of such, whether it be an infection of a specific nature due to some such disease as influenza or tuberculosis, or the result of an asthenic condition secondary to heart or kidney disease or other morbid changes. It is of little use to prescribe for a patient's cough without inquiry into his habits, occupation, surroundings, and general physical condition. How inadequate to prescribe simply an expectorant to a patient who shows albuminuria!

The patient who is advised properly as to hygienic measures may maintain health and secure immunity from frequent "colds;" thus, fresh air in his office by day and his bedroom by night may be a factor that he has utterly neglected and one that, if instituted, may cause a marked improvement in his resistance to the disease. A cold bath every morning preceded by five minutes of calisthenics and followed by a brisk rub-down is a prophylactic measure of well-known efficacy too often neglected. Regulation of the daily exercise should be emphasized, walking, horseback-riding, and gymnastics may be prescribed for those inclined to lethargy, while the danger of overfatigue from the more violent exercises should be pointed out. Advice as to moderation in eating and in the use of alcohol and tobacco should not be neglected. It should be seen that the patient wears the proper kind and amount of clothing, being advised of the foolishness of excessively warm garments on the one hand, and the foolhardiness of exposure on the other. The tendency of parents to inure their children by the use of light clothing, short stockings, sandals, etc., in cool weather should not be tolerated by the physician.

The surroundings of the patient and his vocation may be such that he is inviting the disorder. This is exemplified in workers in metals, stonegrinders and the like, whose lungs are constantly irritated by the fine particles inhaled, or, again, by the clerk who leans for long hours over a desk in an ill-ventilated and overheated office. There are many occupations where exposure is the predisposing cause of the disease; teamsters, painters, plumbers, etc., by continual work in all varieties of weather without change of clothing are subjected to frequent attacks of bronchitis which might readily be averted by moderate care as to their hygiene. Physical defects, such as nasal obstructions, enlarged tonsils, and adenoids, if not the actual cause, are frequently the means of prolonging attacks of bronchitis. The removal of nasal polypi, correction of deflected septæ, and extirpation of adenoid vegetations, by permitting the free inspiration of oxygen, are important measures in the treatment of these patients. Disease of other organs than those of the respiratory tract should be carefully noted and treatment instituted. Chronic heart and kidney disease frequently are the underlying causes of recurrent attacks of bronchitis, and proper attention to these conditions will alleviate the bronchial trouble, which disappears *pari passu* with the improvement of the condition of these organs.

In regard to climatic influence, it may be said that, to those who are able to afford a choice of climates, a removal to a dry, warm atmosphere is always beneficial. Localities such as Southern California, New Mexico, and parts of the South Atlantic States enjoy a reputation among the subjects of this disease. Seaside resorts are also of great benefit to some individuals, especially during the winter months, a few days' sojourn acting as a potent remedy to many of these patients. Some cases do well in the more stimulating atmosphere of the mountains. It is probable that a major part of the benefit derived from a visit to these areas is due to the fact that the patient is on an excursion for his health, and acts accordingly, following the regimen of hygiene with far more interest and more conscientiously than he ever could be persuaded to do at home.

Treatment of Acute Bronchitis.—Abortive.—Prompt and vigorous measures in the early stages of a "common cold," where there is coryza associated with hyperemia of the bronchial mucous membrane, pain in the chest, and the sensation of rawness in the trachea, will at times avert an extension of the process. This treatment depends for its success mainly on diaphoresis, diuresis, and thorough evacuation of the bowels. The patient is given an initial purgative; calomel, gr. j at one dose, is preferable to other drugs. Magnesium citrate, compound jalap powder, or a saline may be substituted. The patient is then given a thorough sweating by means of the hot air bath, best carried out in one of the folding cabinets that are always easily obtainable. He is undressed, wrapped in a blanket, and allowed to remain in the apparatus for from ten to twenty minutes, or until diaphoresis is thoroughly established. A towel rung out of cold water is placed on the head, and during the bath he should be given sips of hot lemonade, hot whisky punch, or other stimulating drink. In lieu of the cabinet, a home-made apparatus may easily be arranged by the use of an alcohol lamp protected by a piece of wire gauze, over which a vessel of water is allowed to boil; this is placed beneath a wooden chair, the patient being covered with a blanket which completely envelops him and spreads over the chair to the floor on all sides. The process may be aided by placing the patient's feet in a hot mustard foot bath. After the bath he is removed to his bed and placed between light blankets or cotton sheets. A Dover's powder is then administered, gr. iij to gr. v, and repeated in three hours if the patient is awake. He should be well covered, and when free diaphoresis has ceased, should be rubbed dry and fresh clothes substituted for the moist ones. If he is already suffering from cough, the following mixture should be given:

R—Potassii citratis	gr. x
Vin. ipecac.	ʒv
Aqua cinnamomi fld.	ʒj—M.

Sig.—This dose to be taken every two or three hours while awake.

On the following day he should remain in bed, and may be given small doses of sulphate of quinine, gr. ij, three times a day, or tincture of nux

vomica, mx , or strychnine, gr. $\frac{1}{40}$, thrice daily. If the attacks subside under this treatment, he is allowed to get up on the third day, and after a cold bath, followed by a thorough rubbing, may resume his ordinary mode of life. If, however, the abortive treatment is not effectual, and the tracheobronchitis is well established on the second day, the patient should remain in bed. Rest is a most important part of the treatment. The room should be well ventilated with cool, fresh air, the bed being protected by screens from any sudden change of temperature. An open wood fire with all the windows raised and exclusion of furnace heat will give the best atmosphere.

Local Applications.—These may be either in the form of heat or cold. Turpentine stupes, mustard plasters, or poultices may be applied to the chest; in children, immersion in a hot mustard bath (a tablespoonful of mustard being added to six gallons of water) is preferable to the jackets or plasters. Hot mustard packs are advised by Heubner. In adults better results, at times, may be had from a cold compress made by soaking several thicknesses of gauze in iced water. The compress is made to cover the chest from the clavicles to the margin of the ribs, and is covered with a piece of light flannel and allowed to remain for fifteen minutes. In this stage, pain along the course of the bronchi may be relieved by dry cups applied over the back of the chest.

Inhalations.—These are probably the most useful of all measures in the treatment of bronchitis, acute and chronic, not only in the early stage, but also throughout the course of the disease. Success, however, is measured by the care with which the inhalations are given and the attention paid to the details of administration. The best means of inhaling vapors is through the medium of the croup kettle or steam atomizer, used in conjunction with a tent. In children any other method of giving inhalations is unsatisfactory and far less efficacious. The tent is easily made by pinning a folded sheet around one side, the top, and foot of the bed, leaving the remaining side open. Another sheet is fastened as a roof over the entire bed. The kettle is placed on a stool by the head of the bed with the spout so directed that the steam is thrown where the patient can easily inhale it. Care should be taken that the tube is long enough to insure that the steam is not too hot as it is ejected from the apparatus. The patient lies on his back or side and the inhalations are continued for a half-hour or an hour at a time or continuously. In acute bronchitis medicated steam is not necessary, although I usually prescribe a teaspoonful of compound tincture of benzoin to a pint of water, as it is more pleasant to some patients than the simple steam. The benzoin also seems to aid the soothing effect of the vapor on the bronchial mucous membranes. I remove the sponge from the arm of the apparatus when using benzoin, as it becomes caked and hardened after a few treatments. If the patient is an adult and not confined to bed, inhalations may easily be given with the aid of a cone made by pinning a towel over a piece of stiff paper and rolling them into the form of a funnel; this is held over a bowl of steaming water to which the benzoin has been added. Other drugs may be employed, such as

thymol, menthol, eucalyptol, phenol, etc. The following is advocated by McPhedran:

R—Ol. pini sylvestris,
 Ol. eucalypti aa gr. xv
 Menthol gr. v
 Magnes. carb. gr. x
 Tr. benz. comp. f3j—M.
 Sig.—A teaspoonful in a pint of hot water.

Drugs.—In the early stages of acute bronchitis, when the bronchial mucous membrane is hyperemic, dry, and irritated, drugs are employed which will exert a soothing effect on the inflamed membrane. Of these, the most useful are opium and its derivatives, ipecac, potassium citrate, and vinum antimonii.

R—Potassii citratis gr. x
 Tr. opii camph. mxx
 Syrupi f3ss
 Aquæ q. s. f3j—M.
 Sig.—One such dose every three hours.

Or,

R—Codein. sulphatis gr. $\frac{1}{4}$
 Mist. glycyrrhizæ comp. f5j—M.
 Sig.—One such dose in water every three hours.

Heroin is a much-used drug when there is frequent irritating cough; it is given alone or in combination with a sedative expectorant in doses of gr. $\frac{1}{16}$ to gr. $\frac{1}{12}$. I believe, however, that codeine is a more reliable and less dangerous drug than heroin. A good combination in the first stage of bronchitis, especially in those cases accompanied by general muscular pains, is as follows:

R—Codein. sulphatis gr. $\frac{1}{16}$
 Camphoræ monobrom. gr. $\frac{1}{2}$
 Aspirin gr. v
 M. et ft. in capsule no. i.
 Sig.—One such capsule every three hours.

For increasing and loosening the bronchial secretion, apomorphine and pilocarpine may be employed; of the former, gr. $\frac{1}{16}$, and the latter, gr. $\frac{1}{16}$, every three hours until the cough is more productive. In children the induction of emesis is of service where dyspnea is marked. The distention of the smaller bronchioles that occurs with the forced inspiration that accompanies the act of vomiting serves to keep these channels patulous. In infants and young children vomiting is more easily performed and less disturbing than in adults, and is best induced by the use of the wine or syrup of ipecac; a single dose of one-half to one drachm of either preparation is sufficient for a child of two years. The use of ipecac in combination with castor oil is advised by Kerley. He gives 3 drops of castor oil and the same amount of syrup of ipecac every two hours for the first three or four days or until bronchial secretion is well established. Aconite, by diminishing fever and slowing the respiratory rate, is a useful drug

in treating either adults or children; it may be given either alone or in combination with spiritus ætheris nitrosi. A child of two years may be given $\frac{1}{2}$ minim every three hours and an adult 5 to 10 minims at the same intervals.

Supportive treatment in this stage of the disease should not be neglected, and such stimulants as strychnine, aromatic spirit of ammonia, alcohol, caffeine citrate, or the carbonate of ammonia may be employed.

In adults tincture of digitalis may be prescribed if there is cardiac weakness; children usually stand strophanthus better than the latter drug, the following prescription being employed:

R—Tr. strophanthi ℥j
 Spts. ammoniæ aromat. ℥x
 Glycerini ℥v
 Elix. aurantii,
 Aquæ āā q. s. f 3j—M.
 Sig.—One such dose in water every three or four hours.

With the establishment of free bronchial secretion, the second stage of acute bronchitis is ushered in and the sedative expectorants are abandoned, to be replaced by those that stimulate secretion. Ammonium chloride still remains the most used drug of this class. It is not usually given alone, but in combination with liquorice or brown mixture. I usually prescribe the following when the patient is strong and the stomach not sensitive:

R—Tr. nucis vomicæ ℥v
 Ammonii chloridi gr. iiss to v
 Elixir. calisayæ q. s. f 3j—M.
 Sig.—One such dose in water four times a day.

Or,

R—Ammonii chloridi gr. iiss to v
 Fluidext. glycyrrhizæ f 3j—M.
 Sig.—One such dose every three hours.

The fluidextract of liquorice I use in preference to brown mixture, as the latter is depressing and as in this stage of the disease the patient is apt to be already depressed. For the same reason I usually prescribe tincture of nux vomica or strychnine as adjuvants to the expectorant. If there is depression, the opiates are to be avoided, but with excessive coughing, morphine or codeine may be combined with the ammonia. For constant irritative cough, I have frequently used a combination advised by Hare:

R—Ammonii chloridi,
 Ammonii carbonatis,
 Ammonii bromidi āā 3j
 Fluidext. glycyrrhizæ f 3iv
 Aquæ destillatæ q. s. f 3vj—M.
 Sig.—Dessertspoonful in water every four hours.

If the expectoration becomes thick and sticky, small doses of sodium or potassium iodide, gr. ij to gr. v, three times a day, will serve to increase

and liquefy the bronchial secretion. The elixir of terpine hydrate and codeine is also useful at this time, and should be given every three or four hours in teaspoonful doses. Terpine hydrate or terebene sometimes succeeds when the chloride of ammonium is ineffectual. A useful prescription is a capsule containing:

R—Codeinæ sulphatis	gr. $\frac{1}{8}$
Camphoræ monobromat.	gr. $\frac{1}{2}$
Terpine hydrate	gr. ij—M.

Sig.—This dose every three hours.

If there is no improvement in the patient's condition at the end of a week's time, it is likely that some underlying morbid process exists, and careful reëxamination of the patient's heart, lungs, and kidneys should be made. In children bronchopneumonia should be suspected as long as there is fever and dyspnea. As previously stated, inhalations are as useful in the latter stages of bronchitis as in the early. Ammonium chloride may be administered in this manner by the use of an aspiratory apparatus such as may be obtained at any pharmacist's. Throughout the disease, supportive and hygienic measures should be carefully carried out. As the cough subsides and expectoration becomes thin and scanty, the expectorants should be abandoned and tonics, hematinics, breathing exercises, and careful regulation of the diet and bowels are in order.

In acute infectious diseases bronchitis is frequently an accompaniment of the infection, and as the stomach is more apt to be sensitive under such conditions, the expectorants should be given in smaller doses or should be omitted. Respiratory stimulants in the bronchitis of measles, typhoid fever, or influenza are often preferable to ammonium chloride or the turpentine group. Fresh air is a most important aid in the treatment, especially in measles, although the family or friends of the patient usually offer objections to this procedure. The admission of plenty of fresh cool air, however, should be insisted on.

Chronic Bronchitis.—The prophylactic measures before mentioned are of the utmost importance to the chronic bronchitic, and of these the most striking results are obtained by change of climate. The removal of the patient to a dry, equable climate is not only useful as a prophylactic step, but also offers a better chance of curing the condition than any other remedial procedure. This is true of all varieties of the disease. The choice of a climate should, of course, be influenced by the variety of the bronchitis the patient presents; warm atmospheres, not subject to sudden changes, are advised for the patient with chronic heart or renal disease, while to those whose trouble is directly due to changes within the bronchial tubes a more stimulating one is preferable.

To those who have not the advantage of choice of locality, much may be done by improving the atmosphere of their home by thorough ventilation, by breathing exercises, and medicated inhalations. By systematic breathing exercises the expansion of the lungs is increased and the finer bronchial tubes are distended, with resulting better oxygenation of the blood. Inhalations are especially useful in chronic bronchitis when the

expectoration is viscid or the patient has difficulty in ridding his bronchial tubes of their excessive secretion. Creosote is the best drug that can be employed. I use 20 to 30 drops in a bowl of steaming water, directing the patient to continue the inhalations for from five to ten minutes twice daily. After each treatment there is usually an increase in the amount of the expectoration, with a very definite sense of relief on the part of the patient. I have tried other medicated vapors and sprays, but to my mind creosote gives the best results. To those to whom the odor of this drug is disagreeable, and it is a most tenacious and permeating one, a large closet or separate unused room should be reserved especially for the inhalations. Counterirritants I have not found of definite aid, with the exception of blisters. I have seen one case where the patient for years had been in the habit of using a blistering salve in her frequent and long-continued attacks, with decided improvement from its application.

Of drugs such as improve the patient's general condition, the most useful are iron, cod-liver oil, arsenic, and strychnine. In children a combination of syrup of the iodide of iron and cod-liver oil is a time-honored prescription. The drugs are best prescribed separately, the iron being added to the oil just before being taken. For a child of two years the syrup of the iodide of iron, gtt. v, added to emul. olei morrhuae, f3j, three times a day, after meals, may be given. In adults when the bronchial secretion is tenacious, potassium iodide should be given in doses of 5 grains three times a day. It rarely upsets the stomach if given after meals, well diluted in milk or water. When the expectoration is copious, creosote, mjj to mlij, three or four times a day, after food, is an effectual drug; it may be given in hot water, in milk, or prescribed in capsules. Creosote carbonate (creosotal) I usually prefer to creosote when the stomach is sensitive; it may be given in suspension with syrup of acacia or in capsules. Guaiacol carbonate is advised by Stevens, in purulent bronchitis. Diuretics and stimulants are needed in special cases, and sodium nitrite or nitroglycerin are often necessary when the arterial tension is high. In many cases of those more advanced in years, the blood pressure is much increased and the administration of the nitrites has a most beneficial effect. Where there is much secretion and the patient is troubled by harassing attacks of coughing, preventing sleep, the act of expectoration may be mechanically aided by elevating the foot of the bed. The cardinal points to be remembered in treating these cases is to bear in mind that expectorants are usually of doubtful value. Success depends largely on improving the patient's general condition by tonics, massage, hydrotherapy, and general hygienic measures. The disease is obstinate, and chances for cure are dubious unless the patient can change his environment at will.

WHOOPIING COUGH.

Whooping cough, or pertussis, is a disease that still stands somewhat in the light of a reproach to the profession; known as it has been to medical

science since the sixteenth century, as yet the cause of the disease has not been definitely demonstrated, and the malady still runs its protracted course in spite of the numerous methods exploited for its treatment. The average duration of the disease is still ten weeks, and it is today one of the most dreaded and most fatal of the diseases of infancy. The statistics dealing with the death rate from pertussis are shocking enough, but when it is considered that many of the infants whose deaths are recorded as being due to bronchopneumonia have in reality had whooping cough as the inaugural infection, it is easily seen that the mortality of this disease is underestimated.

Pertussis exists continuously in most localities, but there are periods in which the number of cases multiply so greatly that the disease becomes epidemic; there is usually a greater number of cases seen during the winter and spring months than in the latter half of the year. Whooping cough is, in all probability, due to a microörganism that has been described as an influenza-like bacillus; agglutination tests have been successfully made with the blood of patients from whom this bacillus has been isolated. (Martha Wollstein.)

The disease is highly contagious, the degree of infectivity being in an inverse ratio to the duration of the individual attack. This fact, unfortunately, tends to the spread of the disease, as it is at the onset and during the early catarrhal stage that pertussis is most contagious, and as at this time the diagnosis is seldom made and isolation has not occurred, transmission of the malady occurs very readily. The highly contagious nature of pertussis has been frequently noted, the disease spreading by contact or proximity, and but rarely through an intermediary. There has been reported, however, instances in which infected clothing has evidently transmitted the contagion. As an example of simple momentary proximity causing the transmission of whooping cough, an instance has been reported of a child contracting the disease by passing in a coach that of another child suffering from pertussis. The infective period of pertussis has not been definitely established; it certainly does not last as long as the whoop or the cough continues, and probably is highly contagious only during the early stage of the disease. Ker believes that by the time the whoop is well established the degree of infectivity is very low, while other authorities maintain that the disease may be transmitted as long as there is expectoration. I have failed to discover a case of pertussis arising in children who have evidently been exposed in the waiting rooms of dispensaries, although this occurs very frequently. This is due probably to the fact that the children in the first stage of pertussis are rarely brought for treatment.

Prophylaxis.—The prophylactic measure that is of the most importance is the isolation of all cases of pertussis until the infective period is over. It is on this account that the early diagnosis of the condition is so valuable. All cases of acute catarrh of the upper air passages in children whose blood shows a lymphocytosis, or whose urine is of an unduly high specific gravity, should be kept under strict surveillance and isolated until pertussis is no longer suspected. The other children of the

household should be carefully watched for the appearance of cough, and should be kept from school for a period of two weeks after the subject of the disease has been separated from them. The duration of quarantine should last as long as there is expectoration. The clothing and the room occupied by the patient should be fumigated at the expiration of his isolation. Delicate children, or those that have rachitis or a bronchitic tendency, should be especially carefully guarded from exposure to the infection. It is advisable if there are other children in the household to disinfect the clothing, linen, etc., that have come in contact with the patient.

General Measures.—If, as is very apt to be the case, there is fever present the patient should be put to bed, and as long as there is any degree of pyrexia the child should remain there. The diagnosis being made the process of isolation should be immediately instituted. If it is possible, two large, well-ventilated rooms, as much separated from the more frequented part of the house as possible, should be selected as the apartments of the patient and nurse; this gives the advantage of frequent and thorough ventilation. One room may be used for sleeping at night, while in the day time the child's bed may be rolled into the second room while the first is being thoroughly aired and cleaned. The room, however, should be kept cool, if possible at a temperature of not above 60° F. The child should wear a woollen shirt beneath the night-gown, and should be kept well covered. I believe that fresh air is as important in the treatment of pertussis as it is in any other pulmonary condition.

If there is no fever, the patient should be kept outdoors as much as possible. If there is a porch, and the patient an infant, the coach may be kept there the greater part of the day. In older children more latitude may be allowed, the child being permitted to be outdoors for walking or driving if the weather is not too inclement, care being taken that intercourse with other children does not take place. The danger of complications decreases in proportion to the age of the patient. In children under two years of age bronchopneumonia is more apt to occur, and it is wiser to keep such patients in bed or in a coach until the severity of the attack has subsided. The patient should be warmly clad with woollen underwear, but care should be exercised with those who are up and about that they should not get overheated.

The diet in pertussis will, of course, depend largely on the age of the child. In infants the problem of a difficult feeding case may be superimposed upon that of the treatment of the disease. The protracted course of most cases generally leads to emaciation, and the frequent attacks of vomiting that accompany the kinks, or paroxysms of coughing, serve to reduce the child's nutrition and weaken its resisting powers. It is necessary, then, to give the patient a diet that will afford the greatest amount of nutrition with the least tendency to gastric irritability. In infants artificially fed, whey and cream mixtures are most efficient; the addition of malted food at times is serviceable. In older children light but nutritious meals should be ordered, with the addition of extra

feedings of milk and broths between meals. By feeding at intervals of every three hours more nourishment is obtained with less danger of loss from vomiting. It is well to give a feeding immediately after a paroxysm that has caused emesis, the chances being that the food will have time to enter the duodenum before another attack of vomiting has occurred. In febrile cases it is well to reduce the diet at once, even in older children, and under such circumstances a milk-and-broth dietary is prescribed. In very severe cases of pertussis, where the stomach becomes extremely unretentive, it is better to stop all food for twenty-four hours at least. Cracked ice or small quantities of water may be given by mouth, and after a day's rest the diet may be resumed by giving peptonized milk or wine whey to older children or plain whey to infants. I have never seen a case of pertussis where rectal alimentation seemed advisable. Ruhrah, however, recommends it in certain cases, and even advises subcutaneous injections of oil in extreme cases. It is of the utmost importance that children with pertussis should be kept quiet and spared all excitement. Anything that irritates the nervous system, which is at this time in an extremely unstable condition, should be avoided. It is better to run the risk of spoiling the child than to exercise too much discipline in one whose condition favors the development of such nervous complications as convulsions, paralysis, or psychoses. A firm but mild demeanor to older children is, however, often a help to them, and at times a parent or nurse may obtain good results from such psychic treatment of an extremely nervous child.

There have been various procedures, other than the administration of drugs, that have been recommended by different authorities. The most widely used is that of the abdominal belt of Kilmer, which has met with notable success in his hands, and in those of various others whose experience he has collected. This band consists of a covering, which reaches from the axillæ to the groins, made of stockinette, and completely enveloping the child's chest and abdomen. Over this is applied an abdominal support of elastic silk; this is sewed on the stockinette envelope, and is made tight enough to exert slight pressure. The idea of the binder is that by its support the paroxysms are diminished and vomiting decreased. It is an excellent procedure in rachitic children, with diastasis of the recti.

I have tried the method of stopping the paroxysms by pushing the lower jaw downward and forward, but have failed. Medicated atmospheres have been recommended by various authors. The use of sulphur, formalin, phenol, etc., being utilized as disinfectants of the room occupied by the patient. These may be useful if there are several apartments at the patient's disposal, but it is doubtful if sulphur fumigation is efficacious, and a room that has been effectually fumigated with formalin needs several days' airing before it is habitable. Inhalations are of value when there is much associated bronchitis, with moderate coughing between the paroxysms. There is no drug better for the purpose than the compound tincture of benzoin, which should be used in the croup kettle. Fresh air is, however, so much to be desired that

it is usually better to have a well-ventilated cool room rather than any medicated vaporization.

Internal Medication.—In spite of the contumely that has been cast on the therapeutics of whooping cough, and the skepticism with which new remedies have been received by the profession, the treatment of the disease by medicines is by no means wholly discouraging. Much may be done for the sufferer from pertussis, and the severity of the paroxysms can almost always be affected by the judicious use of various drugs. That no one drug is a specific is attested by the innumerable remedies that are offered by pharmaceutical firms or lauded by different authorities. It is by the discriminate use of different remedies, by care in their administration, and judgment in changing from one drug to another, at the proper intervals, that the best success in the treatment of pertussis is obtained. There is no doubt that any one remedy will not suffice for the attack, but by alternating one with another, or by using several in succession, the intensity of the disease can be lessened and its symptoms ameliorated.

It is well in prescribing any drug in the treatment of pertussis to remember that the patient has, or soon will have, a hypersensitive stomach. Vomiting is apt to occur as a direct result of the disease, so that care should be taken that the prescription does not increase this tendency or of itself induce emesis. Fortunately there are numerous drugs to choose from, and if nausea is produced by one, another may be immediately substituted. I have had more success with antipyrine than with any other. It is rare, indeed, that no benefit is noticed after its administration, and although it may not shorten the duration of the disease it almost invariably lessens the number and severity of the paroxysms. The following simple formula is prescribed for a child of two years:

R—Antipyrini	gr. j
Spts. frumenti	℥x
Aquæ	q. s. f 3j—M.

Sig.—One such dose in water every three hours.

The alcohol acts as a stimulant, and is a good solvent for the antipyrine. If there is any difficulty in administering the dose a small quantity of simple syrup may be added. For a child of one year gr. $\frac{1}{2}$ every two hours is sufficient, while with those from two to four years of age it is better to give gr. j every two hours instead of increasing the individual dose. I have never seen any ill effects from antipyrine given in moderate dosage, but it should not be used if there is any cardiac weakness. Antipyrine should be continued for one week, and should then be withheld and sodium bromide substituted as follows:

R—Sodii bromidi	gr. ij
Aquæ camphoræ	f 3j—M.

Sig.—One such dose in water every three hours for a child of two years.

I usually prescribe small doses of aromatic spirit of ammonia (℥ x to xv), to be given between the administration of the above; sometimes,

however, it increases the gastric irritability, and should then be immediately stopped. I find that these two drugs, antipyrine and sodium bromide, given alternately for a week at a time, give better results than a combination of the two in one prescription. They can, however, be given together as:

R—Antipyrini	gr. j
Sodii bromidi	gr. ij
Syrupi simplicis	℥xv
Elixir. aurantii	q. s. f 3j—M.
Sig.—One such dose in water every three hours.	

Given in a three-ounce mixture this prescription will keep satisfactorily for a week at least.

The tincture of belladonna stands next in efficiency to antipyrine, and is a more effectual drug than the bromide, but cannot be substituted for it in the method of treatment just described. It must be given continuously, and in fairly large doses, to produce the best results. I usually begin with a minimal dose, as some children have a marked idiosyncrasy for the drug. I once prescribed ℥ij for a child, aged three years, who was brought back to the hospital after the first dose had been taken, in a condition of extreme prostration, with violent vomiting and a typical belladonna rash. The dose can easily be augmented from day to day, and I now never prescribe more than ℥j as the initial dose for any child, while for those under two years ℥ss should be given at first. After this medication is well started the dose may be increased without danger until physiological effects are noted; it should then be reduced slightly. In prescribing belladonna it is wise to instruct the caretaker of the patient as to the limit of tolerance of this drug, not forgetting that belladonna may reduce the quantity of urine appreciably.

Heroin is used by many authorities, and Ruhräh considers it one of the best. He advises its use in doses of gr. $\frac{1}{100}$ to gr. $\frac{1}{24}$ four to six times a day. As heroin is a drug that at times unexpectedly causes rather alarming symptoms, I rarely use it. Dover's powder is the best form of opium to use, especially if there is much nocturnal disturbance. A single dose being given at bedtime, during the treatment by other remedies, gr. ss to a child aged two years is sufficient. Quinine is also excellent in some cases, especially in older children, and is given in doses of gr. ij to gr. iiij, thrice daily, for a child of two years. At times, however, it is not well borne, causing restlessness, insomnia, or gastric disturbance. Neurath suggests the use of quinine enemata. Euquinine is preferable to quinine on account of its tastelessness; it may be given in doses of from gr. ij to gr. v three times a day. Morphine, as used by Triboulet, hypodermically, has been lauded, more especially by the French pediatricians, although Comly does not recommend it. Bromoform (tribrommethane) had a vogue for some time. It is best given in drop doses on sugar or prescribed in a mucilage. The bottle should be thoroughly shaken before the dose is poured out, as the bromoform tends to settle at the bottom of the bottle. Bromoform is a dangerous drug and

numerous instances of poisoning have been noted from its use. Tissier prefers fluoroform; he uses a 2.8 per cent. aqueous solution, giving gtt. j after each paroxysm the first day, two the second day, and so on until gtt. c are given in twenty-four hours to a child of two years. He reports 117 cases so treated without accident, with a reduction of the paroxysms by one-third within three days. Among the other numerous drugs that have been advocated in the treatment of pertussis may be mentioned codeine, alum, camphor, pertussin, antitussin, chloral, inhalations of chloroform for excessive paroxysms, hyoscyamus, ipecac, gelsemium, inunctions of amber oil, etc. Painting the pharynx with a solution of quinine, sprays of silver nitrate (gr. ss to f $\overline{3}$ j) have met with success in some hands. Edson recommends the following inhalation:

R—Creosoti	3iij
Eucalyptol	3ij
Spts. chloroformi	3vj
Terebeni	q. s. 3iij—M.

Sig.—Fifteen drops on a sponge wrung out of hot water.

Aconite is recommended by Hare when there is high arterial tension with danger of hemorrhage. Vaccination has been supposed to have a favorable effect on the course of the disease. Bloch reports success from feeding infants on milk of cows who have received injections of antitetanic serum. Antitoxin sera have been essayed by several, but as yet have not been indorsed by the profession.

PART V

TREATMENT OF DISEASES OF NUTRITION AND DIATHETIC DISEASES

DIABETES MELLITUS, DIABETES INSIPIDUS, SCORBUTUS, AND OBESITY

BY ELLIOTT P. JOSLIN, M.D.

DIABETES MELLITUS

I CONSIDER any patient to have diabetes mellitus and treat him as such, until the contrary is proven, who has sugar in the urine demonstrable by any of the common tests. This is a broad definition, but is safer for the patient than the use of the term glycosuria, which begets indifference.

Physiological Glycosuria. Alimentary Glycosuria.—Sugar (dextrose, glucose, $C_6H_{12}O_6$) is a normal constituent of the urine (physiological glycosuria), occurring in quantities of about 0.05 per cent. Fortunately, this is below the limit of detection (0.1 per cent.) of the usual qualitative tests for sugar. The sugar may appear after a meal rich in carbohydrates (alimentary glycosuria). If the carbohydrates are in the form of starch (alimentary glycosuria *e amylo*), it would signify diabetes mellitus, but in the form of sugar (alimentary glycosuria *e saccharo*), it might or might not signify diabetes. To determine this point Naunyn suggests the administration of 100 grams of dextrose two hours after a breakfast of one-quarter liter of coffee and milk and at least 100 grams of bread. If sugar is then demonstrable in the urine in a quantitatively estimable amount, diabetes mellitus exists.

The drug glycosurias and those of traumatic origin are almost invariably of a temporary nature, so that all doubt concerning the diagnosis of diabetes mellitus vanishes when sugar is constantly found in the urine.

Apparent Increase in the Incidence of Diabetes Mellitus.—The incidence of diabetes mellitus is increasing throughout the world. Greater accuracy of vital statistics in part accounts for this, but only second to it in importance is the growing frequency of routine urinary examinations. A third explanation for this statistical increase in diabetes mellitus is the increase in the duration of life the world over, because diabetes is preëminently a disease of adult life. The total

number of cases of diabetes in the community may, therefore, be greater, without the incidence of the disease having changed. Emphasizing the importance of the above considerations, I submit some of the data upon which the statement has been based that diabetes mellitus is upon the increase. I do this to impress upon physicians the need of, and the advantage to be gained from, a knowledge of the treatment of this disease.

The number of deaths from diabetes per 100,000 in the registration area of the United States for 1870 was 2.1; for 1880, 2.8; for 1890, 5.5; for 1900, 9.7; and for 1905, 13.0. The number of deaths per 100,000 in Great Britain for 1890 was 6.5, and in 1900, 8.6.

Greater accuracy in compilation should be attached to the figures for a single city, and I cite those for Boston as being typical. In 1900 the number of deaths per 100,000 was 15.2; for 1905, 17.3; for 1906, 17.4; for 1907, 17.9; and for 1908, 18.5.

Barringer and Roper, from a study of the frequency with which sugar was found in the urines of 71,729 adults examined for life insurance in New York city, conclude that the incidence of the disease in that city is 1895 per 100,000.

The Improvement in the Treatment of Diabetes Mellitus.—

It is essential that the physician be convinced that his methods of treatment are improving for the successful treatment of a chronic disease, and this I thoroughly believe to be the case in diabetes mellitus. I freely grant that I occasionally see diabetic patients in middle life who claim that they have disregarded treatment and yet have *maintained health and strength*, but investigation usually shows, first, that the type has been mild; second, that the individual is unusually intelligent; and, third, although he disclaims it, that he has really adopted a mode of life and diet essentially consistent with sound treatment.

Success in the treatment of diabetes, as well as of consumption, depends upon an early diagnosis, and all will agree we are in a much more favorable position to make early diagnoses now than were physicians of a former generation. Life insurance plays an increasingly helpful role in this regard. Thus, in 1880 the ratios of individuals examined by life-insurance companies in the United States to the total population was 2 per cent; in 1890, 3 per cent.; in 1900, 6.8 per cent.; and in 1909, 10 per cent.¹

An accurate knowledge of the diet is more responsible for the improvement in treatment than anything else. Twenty years ago the percentage knowledge of carbohydrate in foods began and ended with gluten breads, and these were considered frauds. The importance of fat in the treatment of diabetes was seldom appreciated. The methods then in use for testing the value of a new therapeutic procedure were unsatisfactory.

Complications are less numerous at the present time, and when

¹ These figures are based upon reports of companies to the New York Insurance Department, with an addition of 10 per cent., because of individuals who are examined for insurance, but declined by the company, and of 30 per cent., because of those accepted who lapse their policy. The actual policies are as follows: 1880, 680,681; 1890, 1,276,167; 1900, 3,071,253; 1909, 5,756,426.

they do occur, are more intelligently treated. The older authorities believed tuberculosis to be about the worst foe of the diabetic patient, but now tuberculosis and septic processes are avoided. To-day diabetic coma usually releases the patient. Positive proof of improvement in treatment would be accorded if it could be shown that the average duration of life of diabetic patients was greater to-day than twenty years ago. I can offer my experience with diabetes in childhood upon this point. Forty-eight such cases have been seen in private practice, and of these, 43 are available for statistics. Of these 43 cases, 3 were hereditary cases, lasting 228 and 96 months respectively, and a third is still living. Five have come under my care since September 1, 1910. These 8 cases are excluded in the following summary. Of the remaining 35 cases, with an onset at seventeen years of age or under, 24 have died, and the duration of life of these cases was 18.3 months. Selecting those cases, and they number 14, which have had or are now having careful treatment from within two months of the onset of the disease, the duration of life has been eighteen months. Of these last 14 cases, 8 are alive at present.

Recovery from diabetes takes place now as formerly in only the rarest instances, but that it has occurred most writers agree. Diabetes, like phthisis, is frequently arrested, and many times plays an insignificant role in the patient's life.

Guiding Principles in the Treatment of Diabetes Mellitus.

—No disease demands a knowledge of its pathological physiology for successful treatment more than diabetes mellitus, and with such a knowledge treatment is almost self-evident. For this reason I will discuss certain aspects which I have found peculiarly helpful and a basis for treatment.

Naunyn's Conception of Diabetes Mellitus.—Naunyn recognizes in diabetes a congenital, often hereditary, tendency toward a weakness of the sugar metabolism. This manifests itself sooner or later, with or without apparent cause, in the development of diabetes. If this tendency is of unusual strength, diabetes appears in early life, and such cases are generally severe—"pure" diabetes. But when the predisposition is less intense, insufficiency of metabolism of sugar does not show until the later years of life—the diabetes of elderly people. Finally, there is the "organic" type of the disease, in which it would seem that disease of the liver, pancreas, thyroid, and nervous system was the impulse which led to the insufficiency of the sugar metabolism. Even without any predisposition, disease of such organs may suffice to cause the development of the disease, but, in the presence of such a tendency, it may appear following lesions of other organs less clearly related to diabetes, or in consequence of infectious diseases, operations, and indiscretions of one type or another. Naunyn considers heredity the bond which unites the three types.

The Tendency of the Diabetic Glycosuria is to Increase.—This is best shown in the cases of pure diabetes, but the characteristic is common to all types. Case No. 8 shows this very clearly. A female,

aged sixty, no heredity, began to lose weight in the spring of 1899, and on June 27th 5.6 per cent. of sugar was found in the urine. The patient remained practically sugar-free from July, 1899, to 1909, since which time it has persisted, except during October, 1909, following rigorous dietetic treatment for a carbuncle. In the years preceding 1909, when the urine was free from sugar, there was apparently no progress in the disease, but so soon as sugar permanently appeared in 1909, the sugar steadily increased, although the diet remained unchanged. A glycosuria of 5 per cent. at the onset of the disease yielded to treatment within four days, but eleven years later, when the disease was more established, three days of strict dieting failed to remove 2 per cent. of sugar from the urine. A patient of v. Noorden's showed 45 grams of sugar upon a diet containing 130 grams of carbohydrate. Without change in the diet, one month later the sugar in the urine was 85 grams.

If the Diabetic Patient is Sugar-free, the Tolerance for Carbohydrates Usually Improves.—This tendency of the diabetic patient to gain in tolerance for carbohydrates when in a sugar-free condition is the fundamental principle upon which treatment is based, and the means by which the value of all therapeutic measures is determined. Case No. 194 is a good illustration of this phenomenon. Female, age thirteen, at onset in 1908 did not become sugar-free until the carbohydrates in the diet were reduced to 10 grams, yet in eleven months the tolerance rose until it reached 90 grams. This principle has led Naunyn to say, "From my experience I consider it highly probable that among the early, strictly treated cases, which pass in the beginning as severe, but later take a favorable course, there is many a one for which one must thank this early strict treatment, while, on the other hand, there can be no doubt that the cases which run ultimately a severe course, in the great majority of instances underwent little if any energetic care." The first return of sugar in Case No. 194 took place because the diet was relaxed upon Thanksgiving Day without my knowledge. The patient again became sugar-free, but ten months later protracted strict dieting failed to remove it from the urine—another illustration of the progressive character of the disease.

Hyperglycemia—The Cause of Most of the Complications.—Clinical experience has shown that a patient with sugar in the urine is peculiarly susceptible to infections. Sugar in the urine implies an increase of sugar in the blood and tissues above the normal 0.1 per cent., and in such tissues it has been shown experimentally bacteria flourish better than in normal tissues. If there is only 0.5 to 1.0 per cent. sugar in the urine, the sugar in the blood does not rise to much over 0.1 per cent., but, with increased quantities of sugar in the urine, the quantity of sugar in the blood rises. In long-standing cases of diabetes the quantity of sugar in the blood may attain a considerable degree, and yet only a small quantity of sugar appear in the urine. Apparently the kidney has become less permeable for sugar. These cases become sugar-free with great difficulty. It is well to remember that the diabetic patient alone is safe who excretes no sugar.

The Increase in the Metabolism and the Decrease in the Available Food Supply.—Diabetic patients lose a considerable per cent. of the energy of their food by the excretion of sugar and acid bodies in the urine. The enormous draft upon the food-supply is obvious when we realize that occasionally even as much as 680 grams of sugar (2720 calories) and 100 grams acid bodies (440 calories) may be so excreted. This is also illustrated by Case No. 235.

Case No. 235, male, age twenty-seven at onset in 1901, no heredity, weight 65 kilograms on February 17, 1909,

Ate.			Excreted. ¹		
Substance.	Grams.	Calories.	Substance.	Grams.	Calories.
Protein.....	100 × 4 =	400	Sugar.....	133 × 4 =	532
Carbohydrates.....	55 × 4 =	220	β-oxybutyric acid..	55 × 5 ² =	275
Fat.....	220 × 9 =	1980			
Alcohol.....	30 × 7 =	210			
	Total....	2810			807
		2810 — 807 =			2003 net calories.

The diet thus furnished only (2003 ÷ 65) 31 calories per kilo instead of an apparent (2810 ÷ 65) 43 calories per kilo body weight.

But, apart from this obvious loss of food material, the total metabolism of the diabetic patient is subject to other inroads. The recent experiments of Benedict and Joslin at the Nutrition Laboratory of the Carnegie Institution have shown the total metabolism of diabetic patients to be increased. In a series of 56 experiments, comprising 193 periods, with the respiration calorimeter and 26 experiments, comprising 102 periods, with the respiration apparatus they obtained an increase of 15 to 20 per cent. in the total metabolism, as measured either by the absorption of oxygen and elimination of carbonic acid or by the elimination of heat. These results were obtained with improved facilities for experimentation, and the number of experiments exceeds all those hitherto published. They are at variance with previous work, and must be considered in the future treatment of diabetes mellitus.

Comparison of Carbon Dioxide Eliminated, Oxygen Absorbed, and Heat Eliminated by Diabetics and by Normal Individuals.

Subject.	Carbon dioxide per kilo of body-weight per minute.			Oxygen per kilo body-weight per minute.			Per kilo of body-weight per twenty-four hours.	
	Chair calorimeter.	Bed calorimeter.	Respiration apparatus.	Chair calorimeter.	Bed calorimeter.	Respiration apparatus.	Chair calorimeter.	Bed calorimeter.
	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Calories.	Calories.
Normal individuals.....	3.26	2.95	3.02	3.99	3.51	3.62	29.0	24.2
Diabetes, severe cases.....	3.53	3.15	3.18	4.85	4.25	4.18	33.6	27.6
Percentage increase, severe over normal.....	8.3	6.8	5.3	21.6	21.1	15.5	15.7	13.9

¹ Feces not included.

² See foot-note, p. 442.

The work showed that the increase in the metabolism was greater in 10 severe cases than in 10 severe and 3 mild cases combined. The increase in absorption of oxygen per kilo of body-weight per minute of the severe diabetics over normal individuals was from 15.5 to 21.6 per cent., according to the apparatus employed, and the excess of heat eliminated varied between 13.9 and 15.7 per cent. The lower increase in the elimination of carbonic acid is due to the fact that the diabetics lived upon a diet of fat, and the excretion of carbonic acid is less on a fatty diet than on a diet consisting largely of carbohydrates.

Up to the present time it has been considered that the metabolism of diabetic patients was not only no greater, but perhaps even less, than that of normal individuals, and so good an observer as Naunyn has felt that diabetic patients could subsist on a smaller number of calories per kilo of body weight than ordinary individuals.

Yet to offset the loss of energy by his non-utilization of sugar and β -oxybutyric and di-acetic acids and acetone, and the 15 per cent. increased metabolism, there is a decrease in the available food-supply of the diabetic patient. Protein as well as carbohydrate is usually not wholly oxidized. Fat alone is unrestricted, for although alcohol is well oxidized, it can only be taken in moderate quantities. It is, therefore, the prime duty of the physician to provide a sufficient quantity of available food for his patients, and it is in this particular that I have made the most mistakes in treatment.

The Glycosuria is the Most Trustworthy Symptom.—While the twenty-four-hour quantity of sugar in the urine is not an absolute measure of diabetes, still, in the vast majority of cases, it is an accurate index. Taken alone, the quantity of sugar eliminated is not of great significance, still less the per cent. of a single specimen, but, when compared with carbohydrate intake, it is possible to determine quite definitely the condition of the patient. I should deplore that any one from the above statement should lay undue stress upon this sign, because the strength, the weight, the mental attitude, the presence or absence of complications, and the acidosis are all important, but it remains true that this is the one feature of the disease which is of almost mathematical accuracy, though we often err in thinking of it alone.

The sugar in the urine of diabetic patients varies directly with the quantity of carbohydrate-forming material in the diet. A change of diet is shown by the urine within a few hours. I cite two illustrations. Case No. 220 at the Carnegie Laboratory ate 75 grams of bread and 25 grams of dextrose, containing a total of 70 grams carbohydrate. In the following six hours there was an increase of 30 grams in the sugar excretion. The same patient ate 225 grams of beefsteak (56 grams protein), in which the theoretical maximum of sugar-forming material amounted to 45 grams, and in the following six hours there was an increase of 12 grams in the sugar excretion.

The Nature of the Diabetic Acidosis and its Relation to Coma.—If a healthy individual lives for three days upon a carbohydrate-free diet, the urine voided upon the morning of the following day will

furnish evidence of acid-intoxication, by Naunyn termed acidosis. The acidosis is represented by three bodies— β -oxybutyric acid, $\text{CH}_3\text{—CH}_2(\text{OH})\text{—CH}_2\text{COOH}$, diacetic acid, $\text{CH}_3\text{—CH}_2\text{—CH}_2\text{OH}$, acetone, $\text{CH}_3\text{—CO—CH}_3$. Of the total quantity of acids, 60 to 90 per cent. is made up of β -oxybutyric acid, and the remainder almost exclusively by diacetic acid. It is questionable whether acetone exists preformed in the body, or is simply a decomposition product of diacetic acid. At any rate, it seldom constitutes over 1 per cent. of the total acidosis. The acetone is directly derived from the diacetic acid, and the diacetic acid may have its source in the β -oxybutyric acid, though the recent work of Neubauer suggests that a reversible reaction exists between these two bodies. β -oxybutyric acid is probably a normal product of the body catabolism, being oxidized as fast as it is produced. In the absence of the oxidation of sugar-forming material, or when an insufficient quantity of sugar-forming material is burned in the body, β -oxybutyric acid and its derivatives remain unoxidized and appear in the urine. The oxidation of about 80 grams of carbohydrate in the form of starch or sugar will cause these bodies to vanish from the urines of healthy subjects, and similarly they will vanish when excessive quantities of protein food are consumed. The presence of these bodies in the urine invariably implies lack of oxidation of carbohydrate material.

The acidosis of diabetic individuals differs in no particular from that of normal individuals except in degree. Whereas in normal individuals the acidosis seldom exceeds a few grams, in diabetic individuals it often reaches hundreds of grams; thus Case No. 4, male, age fifteen, no heredity, excreted in three successive days of coma 356 grams, calculated as β -oxybutyric acid. Just as in normal individuals, the presence of these bodies implies non-combustion of or combustion of insufficient carbohydrates, so in diabetic individuals the presence of these bodies implies non-combustion of or combustion of insufficient carbohydrate material. But it is easier for a diabetic individual to acquire an acidosis, because most of the carbohydrate which he eats is lost to his metabolism. If the diet of the diabetic individual is unrestricted, he often eats so large a quantity of carbohydrate-forming material that enough of it is oxidized to prevent the occurrence of these bodies; thus Case No. 295, excreting 10,000 cc. of urine containing 684 grams of sugar, failed to show a positive reaction for diacetic acid. When the carbohydrates in his diet were restricted to even 280 grams, acidosis appeared; when the diet was still further restricted, the acidosis became extreme. When the quantity of carbohydrate oxidized falls below a certain level, not definitely determinable because of reserve carbohydrate (glycogen) in the body, acidosis appears, and it appears to a greater extent the less the combustion of carbohydrate material.¹ The carbohydrate which

¹ The formation of acid never goes on to such a degree that the blood shows an acid reaction. Such a condition is incompatible with life, for if the blood were acid the carbonic acid would be displaced from its combination with an alkali by the stronger β -oxybutyric acid, and set free in every cell of the body, and no alkali would be available to combine with it and take it back to the lungs for elimination.

is formed from protein may prevent acidosis, but in diabetes the full effect of protein is often lost, as in Case No. 220 above cited.

A mild acidosis exerts very little influence upon the individual; but when the acidosis becomes extreme, coma develops, a state similar to that which can be produced in animals by the injection of hydrochloric acid. Such a condition may develop suddenly in the diabetic patient. For example, Case No. 310 showed a moderate acidosis over a period of months, but upon a trip to Europe became seasick, took no food, and coma ensued. Case No. 252, while upon a rather more restricted diet than usual, underwent unexpectedly considerable physical exertion and coma developed. Case No. 220, having lived comfortably for years despite a severe acidosis, was attacked with indigestion and fasted for two or three days, and thereupon coma appeared. So soon as oxidation of carbohydrates ceases, whether due to exclusion of carbohydrate-forming material from the diet or depletion of glycogen in the body, or because of the incapability of the organism to burn carbohydrates, coma ensues.

The acid bodies which make up the acidosis are continually being produced in severe diabetes and continually excreted, but in the form of their salts—*e. g.*, sodium β -oxybutyrate and sodium diacetate. The diabetic organism furnishes the elements for the formation of these salts, either from the diabetic diet, which is rich in alkali, or in time of need by deflecting the path of excretion of the daily metabolized nitrogen from urea to ammonia, and it is interesting to note that one gram of ammonia ($\text{NH}_3=17$) is five times as effectual in neutralizing an acid as sodium bicarbonate ($\text{NaHCO}_3=84$). Rarely, the body employs another resource by the excretion of calcium and magnesium through the urine, instead of allowing it to take its customary path through the intestines.

The elimination of β -oxybutyric acid is quite as important as its neutralization. It is excreted in the urine in a concentration seldom rising above 1.5 per cent. For the elimination of large amounts of β -oxybutyric acid the quantity of urine must be great and the liquids consumed by the patient considerable. This explains an occasional recovery from diabetic coma by the use of salt solution.

Observations upon the patients studied at the Carnegie Laboratory have convinced Dr. Benedict and me of the great importance of the reserve of carbohydrate (glycogen) in the body in its relation to acidosis. In a healthy individual, although carbohydrates are excluded from the diet, the individual does not lose his reserve of glycogen for days, and this can be demonstrated by a determination of the respiratory quotient. The respiratory quotient in its relation to diabetes is deserving of more attention.

The respiratory quotient represents the relation between the carbonic acid eliminated by the individual to the oxygen that he absorbs in the same unit of time— $\frac{\text{CO}_2}{\text{O}_2} = \text{R. Q.}$ It is an index of the *character* of material burned or oxidized in the body. If this material is carbohydrate, *e. g.*, glucose, $\text{C}_6\text{H}_{12}\text{O}_6$, the volume of CO_2 excreted will be exactly the volume of O_2 absorbed, because the balance of the glucose

molecule contains enough oxygen to oxidize the hydrogen contained in it. Therefore, the respiratory quotient for carbohydrates is 1.0, and the more a patient lives on carbohydrate-forming material, the nearer his respiratory quotient approaches 1.0. When fat is burned in the organism, oxygen is required not only to oxidize the carbon in the fat molecule, but for most of the hydrogen as well, as will be seen by ex-

amination of the constituents of a molecule of fat, C_3H_5 $\left\{ \begin{array}{l} O-C_{15}H_{31}CO \\ O-C_{15}H_{31}CO \\ O-C_{15}H_{31}CO. \end{array} \right.$

The respiratory quotient of fat is 0.71. Protein occupies an intermediate position, and its respiratory quotient is 0.81. On a mixed diet the respiratory quotient of normal individuals is about 0.85, but the respiratory quotient upon a diet of fat and protein is 0.73. In the 10 severe cases of diabetes studied at the Carnegie Laboratory, the respiratory quotient was 0.74, proof positive of the scant store of glycogen upon which diabetics can draw in an emergency. The amount of glycogen in the body of a healthy individual is computed to be approximately 400 grams, chiefly contained in, and about equally divided between, the liver and muscles. In diabetic patients the quantity of glycogen is far less, and it is not strange that starvation, whether therapeutically produced or accidental from seasickness, indigestion or strenuous exercise should exhaust this minimum. The mystery of the sudden onset of diabetic coma is thus explained.

The Weight of Diabetic Patients.—Patients with diabetes lose weight rapidly in the early stages of the disease—28 per cent. of their highest body weight was the loss in several of my cases before they came for treatment. The weight, next to the glycosuria, is the best index of the progress of the disease. Diabetic patients should be weighed, preferably naked, before breakfast, and after the urine has been voided, for patients frequently void a pound of urine at a time. Clothes weigh from 8 to 10 pounds in the summer and 10 to 12 pounds in the winter, but women's clothes weigh less. The weight of a diabetic patient should not fall more than 2 to 3 kilograms ($4\frac{1}{2}$ to $6\frac{3}{4}$ pounds) during the beginning of treatment. Marked gain in weight is not desirable.

Edema is a common source of error, and it is important to recognize it as a cause of gain in weight. Patients may apparently be gaining, when in reality they are actually losing body tissue because of an insufficient diet. Patients who are subjected to protein and carbohydrate-free days, and patients who are taking much alkali, may show it. Dr. Goodall and I found that the oedema was closely related to the administration of alkali, but in a severe case of diabetes to whom alkali was given in large quantity, but the diet kept salt-free, no oedema appeared. In other severe cases of diabetes we were able to increase body weight by the administration of salt. In my opinion, the appearance of oedema in diabetic patients is usually due to the incapacity of the kidneys to excrete salt. The administration of sodium bicarbonate favors the elimination of salts of β -oxybutyric acid. This embarrasses the kidneys still more, and under such conditions oedema is more apt to result. The

weight of patients sharply falls preceding coma, and I have never seen or heard of a patient with diabetic coma who showed œdema when death occurred. Successfully treated cases of coma occasionally show œdema.

The Examination of the Urine in Diabetes.—An early diagnosis in diabetes is as important as in tuberculosis. The disease begins insidiously, as a rule, and its detection depends upon frequent examination of the urine of all patients. We physicians must consider it to be inexcusable to neglect the examination of the urine of any case coming for treatment, and I believe so much significance to be attached to this point that if the physician is unable to get the urine, he should record this fact for his own protection. This applies to practitioners in all branches of medicine. Most cases of diabetes go on for months, many for years, without being diagnosed.¹

The mixed twenty-four-hour quantity of urine should be examined. for many cases of diabetes show sugar in the urine at only one portion of the day. The urine most apt to contain sugar is that voided after the noon-day meal, and the urine least apt to contain sugar is that voided on rising.

The volume of the urine may be little index of the severity of the disease. Case No. 8, twelve years after the onset of the disease, showed 2.4 per cent. sugar in 1125 cc. of urine. Case No. 340 showed 5.8 per cent. of sugar in 1860 cc. of urine. However, it is unusual for the volume of urine to be normal unless the patient is sugar-free. The quantity of urine frequently coincides with the quantity of sugar eliminated. There is one notable exception to this rule. Severe cases of diabetes passing through a period of restricted diet should show a steady and daily diminution in quantity coincidentally with changes in the diet, but when the volume remains constant or rises, it is always a danger-signal and signifies an increasing acidosis. The quantity of urine increases to better eliminate the acids formed.

The volume of the urine should be expressed in cubic centimeters. This enables the per cent. and twenty-four-hour amount of sugar to be most readily calculated.

Sugar.—The quantity of sugar in the urine should be recorded in per cent. and grams for twenty-four hours.

Many of the qualitative tests for sugar are excellent, but I have found the *Fehling's test* to be most generally useful. In performing the test 3 to 5 cc. of equal quantities of the copper solution and the alkaline solution are mixed in a test-tube and thoroughly boiled. If no reduction takes place, the solutions are in good condition. A quantity of urine equal to one-half the volume of the mixed reagents is then added, and the whole boiled vigorously again. Occasionally, substances in the urine other than sugar reduce the copper upon prolonged boiling, but

¹ I cannot too strongly condemn the practice of sending urines of diabetic patients to drug-stores for examination. The reports are delayed, the inconvenience to the patient is increased, and the added expense deters the patient from allowing the physician to keep in close touch with his case.

this is so exceptional that I consider it far safer to boil a second time, but when in doubt, repeat the test without boiling. If there is still doubt, employ the fermentation test: 100 cc. urine are placed in a vessel with a small opening to prevent evaporation, and half of a yeast cake, thoroughly broken up, is added. Place in a warm, but not too warm, place. At the end of twenty-four hours, if the filtered urine which previously showed a doubtful test for sugar with Fehling's solution shows no reduction upon repetition of the test, it can be assumed that fermentable substance was present. In case of further doubt, confirm with the polariscope and the phenylhydrazin tests.

Lactose may give rise to confusion, but the cases in which it is apt to occur are usually known to the physician. Pentose occasionally is present, and probably will be met with more frequently in the future now that attention has been called to it.

While qualitative tests for sugar in the urine are most satisfactory, quantitative tests are not. The best quantitative test for sugar for physicians who do not devote unusual attention to diabetes is the *fermentation test*. To 100 cc. of urine of known specific gravity, one-quarter of a fresh yeast-cake, thoroughly broken up, is added, and the whole set away at a temperature of 30°–35° C. Twenty-four hours later the urine is tested with Fehling's solution. If a reduction is obtained, it is set aside for further fermentation. Complete fermentation having been proved, the specific gravity is taken after the urine has acquired its original temperature, preferably 20° C., and the loss in specific gravity multiplied by 0.23 gives the per cent.

The polariscope is the most convenient of all quantitative tests for sugar, for it may be performed during the patient's visit, and the result of it can be utilized for treatment. Unfortunately, it is inaccurate in the presence of the levorotary β -oxybutyric acid.

Methods for the Determination of the Acidosis.—The reaction of the urine furnishes the simplest method. Whereas one frequently meets with a neutral or alkaline urine with normal individuals, this is rarely the case in diabetes, for the rich protein diet of diabetic patients favors an acid reaction. Ordinarily, 5 gm. of sodium bicarbonate will render the urine of a normal subject alkaline, but in severe diabetes 30 gm. have little effect. Case No. 246 took 170 gm. of sodium bicarbonate in four days, and yet the reaction of the urine remained acid. I do not know of a simpler or safer test for the estimation and treatment of acidosis in diabetic patients.

Test for β -oxybutyric Acid.—The tests for β -oxybutyric acid are all complicated, because they depend upon the extraction of the acid. Estimation of the β -oxybutyric acid based upon the difference between the quantity of sugar, as determined by the Fehling's fermentation and polarization tests, are inaccurate. They simply suggest the presence of β -oxybutyric acid. I use Black's¹ quantitative method.

Diacetic Acid.—In the absence of a ready clinical test for β -oxybutyric acid, one is compelled to resort to a test for its derivative,

¹ Black, Jour. Biol. Chem., 1908, 5, p. 207.

diacetic acid. Diacetic acid represents about 30 per cent. of the total acidosis, and the β -oxybutyric acid does not vary with it—3 to 5 cc. of an aqueous solution of ferric chloride are added to 10 cc. of urine. A precipitate of phosphates may appear, but usually disappears with an addition of more ferric chloride. The depth of the Burgundy-red color obtained is an index of the quantity of diacetic acid present. I record the intensity of the reaction by one to four plus signs. I can confirm Lũthje's statement that the acidosis may actually be extreme, and yet its extent, as indicated by the ferric chloride test, appears slight and vice versa.

The estimation of *acetone* was the first method for the determination of the acidosis, but, because of the small role which it plays in the total acidosis, I have given it up.

Ammonia.—The quantity of ammonia in the urine is a measure of the reaction of the body to the acids produced in it, and to this extent its estimation gives a more accurate idea of the acid production of the body than any other means at our disposal. It is of less value, however, so soon as an alkali is administered, because under such conditions the ingested alkali is used by the body in preference to ammonia. I employ Folin's method. The ammonia-nitrogen nitrogen (NH_3N)N ratio is also useful. The normal amount of ammonia in the urine varies between 0.5 to 1 gm.; in diabetes it may rise to 6 gm., rarely more. Ordinarily, the ratio between the ammonia nitrogen and the total nitrogen of the urine is fairly constant at 1 to 25 (4 per cent.). In severe acidosis this often rises to 1 to 5 (20 per cent.), and has in one of my cases, Case No. 139, risen to 1 to 2.5 (41 per cent.). These high percents are ordinarily only obtained when the total quantity of nitrogen in the urine is small.

Nitrogen—Kjeldahl's Test.—The determination of the nitrogen in the urine is valuable not only for the estimation of the ammonia nitrogen ratio, but because it furnishes an index of the quantity of protein which the patient is disintegrating. Most of the protein metabolized finds its exit from the body through the kidneys. I cannot attach much value to the ratio existing between the nitrogen and dextrose excretion, because the two are not simultaneously excreted, and, further, we never know the glycogen reserve of the body at the time the test is performed.

Albumin.—The test for albumin should be always performed when the urine is examined. Too often the diagnosis of diabetes leads us to neglect the general treatment of the case.

Casts.—From the time of Kũlz the irritation of the kidneys in the first stages of diabetic coma has been observed. Over and over again I have seen typical "showers" of casts at the beginning of diabetic coma. The albumin in the urine at such times may be only a slight trace.

Dietary and Urinary Chart.—It is advantageous to bring together the results of the urinary tests with the records which are made of the diet. My own treatment of patients has notably improved since I began the use of combined dietary and urinary charts. In this way the progress of the disease and the results of new methods of treatment, dietetic

or otherwise, are registered at once. I cannot too strongly urge the use of some such arrangement. I insert the chart devised by Dr. Goodall and myself on pp. 440 and 441.

The Diet of Normal Individuals.—The diet of normal individuals varies greatly, but a normal ration for a man at moderate work would contain about 450 gm. of carbohydrate, 100 gm. of protein, equivalent to 16 gm. of nitrogen, and 75 gm. of fat.

1 Gm.	Calories.	Calories.	Calories required per kilo body-weight per 24°.
Carbohydrate ¹	$4 \times 450 = 1800$	At rest.....	30 to 35
Protein	$= 4 \times 100 = 400$	Light work.....	35 to 40
Fat	$= 9 \times 75 = 675$	Moderate work.....	40 to 45
		Hard work.....	45 to 60

The caloric needs of the body vary not only from hour to hour, but from minute to minute. A group of normal individuals at the Carnegie Laboratory eliminated 24.2 calories per kilo body-weight per 24 hours while in bed, but 29 calories while sitting in a chair. The expenditure of about 1 calorie of heat is required to rise from the sitting position in front of a door, extend the arm, turn the key in the door, and sit down. To walk an hour on a level road at the rate of 3 to 4 miles an hour requires 170 calories above the resting metabolism.

Carbohydrate.—Two-thirds of the diet of a normal individual consists of carbohydrate. Naturally, these figures are only approximate, but it is evident how large a place it occupies in the daily ration.

Protein.—The quantity of protein in a normal diet is probably considerably less than Voit's 125 gm. Thus, twenty-four students of the Harvard Medical School in Professor Cannon's course found their average urinary excretion of nitrogen to be 13 gm. The quantity of protein metabolized to produce this excretion of nitrogen, adding 2.0 gm. for nitrogen eliminated by the feces, would be about $((13 + 2.0) \times 6.25)$ 94 gm.

Fat.—The quantity of fat in the diet varies. Fat is a concentrated food, not only because it has twice the caloric value of carbohydrate and protein, but because it occurs more frequently in pure form—oil, butter, cream, lard, bacon.

The quantities of carbohydrate, protein, and fat found in an ordinary diet can easily be calculated from the diet-chart. This is purposely simple, because a diet-chart to be useful must be carried in one's mind. The percentage of carbohydrates in the food is given to only within 5 per cent., because, except in the most exact scientific experiments, the errors in the preparation of the food are too great to warrant closer reckoning. The figures for protein can be considered sufficiently reliable, as shown by an analysis of a typical day's diet at the Carnegie Laboratory.

The Diet of Diabetic Individuals.—The diet of the diabetic patient should contain, except for brief intervals, the same number of calories

¹ In this article the caloric values of carbohydrate and protein are reckoned as 4, of fat as 9, and of alcohol as 7.

Strict Diet.—Meat, poultry, game, fish, clear soups, gelatine, eggs, butter, olive oil, coffee and tea; and for variety, tongue, sweetbreads, tripe, kidneys, pigs' feet, brains, bone-marrow, anchovies, caviar, lobster, crabs, sardines, shrimps, bologna sausage, smoked or pickled meat, or fish.

Per Cent of Carbohydrates in—				
5% or Less		10% +	15% +	20% +
Lettuce	Cauliflower	Onions	Green-peas	Potatoes
Spinach	Tomatoes	Squash	Artichokes	Shell beans
Sauerkraut	Rhubarb	Turnip	Parsnips	Baked beans
String-beans	Egg-plant	Carrots	Canned lima-beans	Green corn
Celery	Leeks	Okra	Apples	Boiled rice
Asparagus	Beet greens	Beets	Pears	Boiled macaroni
Cucumbers	Watercress	Mushrooms	Apricots	Plums
Brussels sprouts			Cherries	Bananas
Sorrel	Butternuts	Lemons	Currants	
Endive		Oranges	Raspberries	
Unsweetened and unspicied pickle		Cranberries	Huckleberries	Almonds
Ripe olives	Clams	Strawberries		
Grape-fruit	Scallops	Blackberries	Pecans	
	Fish roe	Gooseberries	Filberts	
		Peaches	Walnuts	
		Pineapple	Pistachios	
		Watermelon	Beechnuts	
		Muskmelon		
		Brazil nuts		
Food. 100 Gm.	Protein.	Fat.	Carbohydrates.	Calories, Approximate.

Beef, mutton, fowl, fish (un-cooked).....	20	5 to 10	..	125 to 170
Ham.....	20	25	..	300
Bacon.....	12	50	..	500
1 egg (about 50 gm., without shell).....	65	5	..	75
Milk.....	3	4	5	70
Cream, good.....	3	20	3	200
Cream, very thick.....	3	40	3	400
Butter.....	1	85	..	800
Cheese.....	25	33	2	400
Bread.....	9	1	60	275
Wheat flour.....	12	....	75	350
Rice.....	8	....	80	350
Oatmeal.....	16	7	66	375
Potato.....	2	....	20	90

Vegetables lose carbohydrates in the cooking, especially if the water is changed twice. It is approximately correct to consider a mixture of those in the 5 to 6 per cent. groups as containing 3 per cent. carbohydrates, or 1 gm. to the ounce. Meat loses 25 per cent. water in the cooking.

Starch is better assimilated than sugar in glycosuric patients.
 Potatoes and eggs of similar size weigh about the same.
 One egg and 25 gm. cooked (1 oz. uncooked) meat contain equal amounts of albumin, or approximately 1 gm. nitrogen; 6.25 gm. albumin contain 1 gm. nitrogen.
 One gill (3 tablespoonfuls) oatmeal weighs 36 gm. (containing 1 gm. nitrogen and 24 gm. carbohydrate), and this, if cooked, amounts to (4 tablespoonfuls) 250 gm. Approximately, 80 gm. glucose may be formed from 100 gm. albumin.
 1 gm. albumin contains 4 calories.
 1 gm. carbohydrate contains 4 calories.
 1 gm. fat contains 9 calories.
 1 gm. alcohol contains 7 calories.
 1 kilogram = 2.2 pounds. 30 grams (gm.) or cubic centimeters (cc.) = 1 ounce.
 A patient "at rest" requires 30 calories per kilogram body-weight.

Consult the Chemical Composition of American Food Materials, Bulletin No. 28, U. S. Dept. Agriculture, Office of Experiment Stations, Washington.

Date	Orders	Breakfast	Forenoon	Dinner	Afternoon	Supper	Night
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Date	Vol.	Sp. gr.	Reac.	Alb.	Ace- tone	Di- acetic acid	B-oxy- bu'ric acid	Ni- tro- gen	Ammonia		Rotation		Urine Total sugar
									Total	% of Nitro- gen	Fehl- ing's	Fer'ta- tion		Before Fermentation	After

Carbo- hydrate	Pro- tein	Diet		Alco- hol	Calo- ries	Carbohy- drate balance	NaHCO ₃	Weight of patient	Remarks
		Nitro- gen	Fat						

as that of a normal individual, and, in addition, not only calories sufficient to offset the loss of sugar and β -oxybutyric acid in the urine, but also that due to increased metabolism. In reckoning the total calories which the diabetic diet contains, it is always necessary to bear in mind that for each gram of sugar in the urine 4 calories are lost to the organism, and for each gram of β -oxybutyric acid, 5 calories.¹

Carbohydrate.—The carbohydrate in the diet of diabetic patients must be restricted and seldom exceed 100 gm. Of the carbohydrates administered to diabetics, starch is better assimilated than sugar, but there is no difference in the assimilability for different forms of starch unless the starch is taken in an exclusive form. (See sections upon Oatmeal, Milk, and Potato Cures.)

Levulose is not usually tolerated any better than ordinary sugar. Lactose in rare instances is better tolerated, but the milk diet is an undernutrition diet, and whenever there is undernutrition in diabetes, carbohydrates are better utilized. Maltose is particularly poorly borne, and consequently beer is contraindicated.

According to the diet chart, various vegetables and fruits contain 5, 6, 10, 15, and 20 per cent. carbohydrates. But the quantity of carbohydrate actually present in those of the 5, 6, and 10 per cent. groups, when cooked, is far less. Von Noorden points out that 100 gm. of raw spinach contain 2.97 gm. carbohydrate, but cooked spinach only 0.85 gm. Similarly, 100 gm. of ripe peaches contain 9.5 gm. carbohydrate, but when boiled and the water changed, only 1.8 gm. At the Carnegie Laboratory a raw apple weighing 118 gm. contained 6.4 gm. carbohydrate, but another weighing 114 gm. when stewed, 4.9 gm. Some of the vegetables in the 10 per cent. groups undoubtedly contain, even after being cooked, more than 3 per cent. carbohydrate, but in others there is far less, and it is probably safe to estimate the carbohydrate in a mixture of these 5, 6, and 10 per cent. vegetables at 3 per cent.—approximately 1 gm. to the ounce.

Protein.—The quantity of protein required by the diabetic patient is certainly as great as that required by the healthy individual. Until the Chittenden low-protein diet is proved to be entirely satisfactory for healthy individuals over a long series of years, it is best not to have recourse to it in the treatment of diabetes. An excessive quantity of protein, on the other hand, is also harmful. Case No. 295 excreted 34 gm. of nitrogen, equivalent to 212.5 gm. protein, in the first twenty-four hours during which he came under observation.

The diabetic patient, like the normal individual, reacts quickly to the ingestion of protein in the diet by showing an increased metabolism. Thus, Case No. 220 showed an increased carbon dioxide elimination of 15 per cent., an increased absorption of oxygen of 12 per cent., and an increase of 10 per cent. in elimination of heat following a meal of beefsteak.

¹ One gram of β -oxybutyric acid yields 4.4 calories, but as the total acidosis exceeds the total β -oxybutyric acid eliminated, to get an idea of the energy lost in the acidosis I arbitrarily allow 5 calories for each gram of β -oxybutyric acid excreted.

Since the advocacy of a restricted protein diet by Cantani, and later by Naunyn, the tendency has been to restrict the quantity of protein far more than these authors originally advocated. Naunyn, for example, frequently mentions 125 gm. protein (20 gm. nitrogen) (500 gm. cooked, 625 gm. uncooked meat) in the diet-lists of his patients, but I am inclined to believe that he usually employs a somewhat smaller quantity. Restriction of protein is one of the best methods at one's disposal to render the urine free from sugar, but its use should be restricted to a very short period.

The exclusion of carbohydrates from the diet usually renders the urine sugar-free, but it occasionally fails. One reason for this lies in the fact that patients may replace the carbohydrate with protein (Naunyn's paradoxical glycosuria). The protein molecule contains an appreciable amount of preformed carbohydrate, certain varieties of protein more than others, but this preformed carbohydrate in the protein molecule is insignificant. The chief source of sugar in protein lies in the amino-acids which it contains, and of these, leucin is the one from which sugar is most readily derived. Casein contains an especially large amount of leucin, and for this reason is often poorly tolerated. The more slowly protein is absorbed, the less apt it is to give rise to sugar.

The quantity of sugar supposed to be formed from protein by the diabetic organism has varied with the experimenter. Minkowski found that 2.8 gm. of dextrose appeared in the urine of his depancrea-tized dogs for each gram of nitrogen giving a D : N ratio of 2.65 : 1. $\left(\frac{2.85 \text{ gm. dextrose}}{1 \text{ gm. nitrogen} = 6.25 \text{ gm. protein}} = \right)$ 45 per cent. Lusk, working with animals treated with phloridzin, found 3.65 gm. of dextrose for each gram of nitrogen $\frac{3.65 \text{ dextrose}}{6.25 \text{ gm. protein}} = 60$ per cent. Falta has recorded still higher figures. The theoretical maximum of carbohydrate which can be formed from protein is 83 per cent. The formation of urinary sugar out of protein explains why many diabetic patients are not free from sugar, although their diet is free from carbohydrate. As we do not know the amount of reserve glycogen in these diabetic patients, we cannot say how much of the sugar in the urine comes from it and how much from protein.

Fat.—Fat in any form is utilized by the diabetic patient, and if any sugar is formed from fat, the quantity is negligible. It is true that fat is the chief source of β -oxybutyric acid, and of the various fats, milk-fat is the form which probably participates most actively in its formation, but unless the quantity of milk-fat is in excess of 150 gm., it is not of significance. Patients with only an indifferent digestion double and even treble the quantity of fat with impunity. It is, however, unwise to force the patient, and I have in recent years taken pains to increase the fat gradually in the diabetic diet in order to save the digestion.

The quantity of fat which a diabetic must consume is considerable. Remembering that the diet of a healthy individual contains 450 gm. of carbohydrate, yielding 1800 calories, and that nearly all this quantity

is useless to the diabetic patient, it is obvious that the quantity of fat in a severe case must be greatly increased, theoretically to 200 gm. ($1800 \div 9$), and the diet in even a moderately severe case of diabetes should include 150 gm. Fat is most agreeably taken as cream. The 20 per cent. cream is usually borne much better than heavier cream. The quantity of sugar in 250 cc. (2 gills) of 20 per cent. cream is only 6 gm. Occasionally patients bear butter better than cream, and, as a rule, unsalted butter is preferred. Ninety grams of butter (75 gm. fat) are easily worked into the diet, as is also 15 to 30 gm. of olive oil. Meat contains a variable quantity of fat according to the variety. In lean meat there is about 5 per cent. of fat, while in bacon not far from 50 per cent. The amount of fat in cheese is also variable, but it may be set down as about 33 per cent. fat. An egg contains 5 gm. of fat.

Usual Fat Ration of Diabetic Patient

Substance.	Gm.	Per cent. Fat.	Total Weight of Fat Gm.
Cream.....	250	20	50
Butter.....	90	85	76
Oil.....	15	100	15
Meat.....	240	5	12
Bacon.....	30	50	15
Cheese.....	30	33	10
3 eggs.....	15
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Alcohol.—In no disease is the employment of alcohol more useful or more justifiable. It is an agreeable form of food, and helps the digestion of fat. Sixty grams of whisky contain 30 gm. alcohol, equivalent to (30×7) 210 calories. My patients usually drink less alcohol than this, but one-half the quantity will replace about one-twentieth of the total diet, and allows the omission of ($105 \div 9$) 12 gm. of fat. Finally, alcohol may decrease the acidosis, either directly or indirectly, by preventing disintegration of body fat. The alcohol can be given either as whisky, brandy, rum, or gin, all of these preparations being free from sugar, and containing about 50 per cent. alcohol; or as a sour Rhine or Moselle wine, or claret or Burgundy, these latter preparations containing approximately 10 per cent. alcohol.

Liquids.—It is not necessary to restrict the liquids in diabetes. The diminution of the carbohydrate in the diet usually leads to a corresponding diminution in the thirst and quantity of urine. I hesitate to restrict liquids in severe diabetes for fear too little liquid will be available for the body with which to eliminate the acids which have been formed. Patients often upset the digestion by drinking large quantities rapidly. This is avoided by allowing only half a glass of liquid at a time.

The Prophylactic Treatment of Diabetes.—Prophylactic treatment of diabetes will surely play an important rôle in the future. The tendency to diabetes remains long latent, and undoubtedly breaks out temporarily long before the glycosuria becomes permanent. Frequent routine examinations of the urine, especially in the course of any illness

or convalescence therefrom, may reveal this tendency. Physicians should be on the lookout for diabetes in patients who either lose or gain weight rapidly; should seek for it in well-nourished individuals, who have given up exercise and taken on added responsibilities; should expect to find it often in pregnancy, and always bear it in mind in those families where there is a heredity taint. The utmost tact is here required, for harm may be done by too close supervision.

The consumption of carbohydrates, particularly sugar, should be regulated in all these classes of individuals. Such patients should be spared undue nervous excitement and afforded relaxation of body and mind. From the good effect of such treatment in established diabetes one has reason to believe it doubly efficacious in susceptible individuals.

Classification for Purposes of Treatment.—A classification based upon the assimilation of carbohydrate will always be found helpful in the treatment of diabetes. Such a classification can never be arbitrary, because cases which at first appear to belong to the severest type of the disease may run a favorable course, and cases showing at the outset a small quantity of sugar and a low acidosis, may prove to be quite intractable. I usually assign cases to one of the three following groups:

Mild Diabetes.—These patients become sugar-free, and show a tolerance at the outset for at least 50 gm. carbohydrate, and upon such a diet present no evidence of acidosis. Positive carbohydrate balance, 50 gm. or more.

Moderately Severe Diabetes.—The patients become sugar-free upon a diet free from carbohydrates, except for the few green vegetables. The acidosis is only moderate. Carbohydrate balance = 0 to 50 gm.

Severe Diabetes.—This group includes all cases which have failed to become sugar-free, or have only become sugar-free transitorily when carbohydrate-free days and starvation-days have been employed. The carbohydrate balance is invariably minus, the acidosis extreme.

Treatment.—The treatment of diabetes is so preëminently dietetic, and it is so easy to fall into schematic ways, that I feel it especially important at the very outset for the physician to take a comprehensive view of the case. Therefore, determine whether the diabetes is causing most of the symptoms or is really subsidiary to other influences. This is particularly true in the diabetes of middle life or old age.

Again, whenever in the course of treatment unsatisfactory results are obtained, critically examine the patient anew to determine whether some radical alteration in the plan of treatment is not necessary. Nothing is more fatal to good results in treatment than to work in narrow lines. Just as surgeons often overlook grave medical complications in their cases, simply because their attention is exclusively directed to the surgical aspect of the case, so physicians in the treatment of diabetes allow obvious complications or intercurrent diseases to escape their notice.

Etiological Treatment.—The etiological treatment of diabetes is unsatisfactory. Syphilis would appear to offer an ideal opportunity for the etiological treatment of diabetes, because it attacks organs standing in close relation to it. Unfortunately, though syphilis is commonly

enough encountered in diabetic patients, experience shows that treatment directed toward it has seldom yielded favorable results. Several of my cases of diabetes which have extended over long periods, one for thirty-five years, gave a history of syphilis preceding the onset of the disease, but antisiphilitic treatment was not of value.

Pancreatic extracts and the pancreas itself have proved valueless when subjected to critical tests. If there is deficient absorption of fat in the alimentary tract, such preparations may well be employed. So far as I am aware, no preparation is equal to the fresh gland.

Symptomatic Treatment.—The aim of symptomatic treatment is to maintain the diabetic patient in a sugar-free condition, and yet preserve his mental and physical well-being. By so doing we are practising symptomatic treatment in the broadest sense, because the annoying symptoms, polyphagia, polydipsia, polyuria, pruritus, debility, and the host of complications which hover over the diabetic patient are thereby lessened or removed. It is possible to remove the sugar from the urine of a diabetic patient in various ways, but the dietetic method alone removes the sugar and at the same time builds up a tolerance for carbohydrates.

The simplest method of removing the sugar from the urine of a diabetic patient would be temporary starvation, and there is something to be said in its favor. No digestive upset would occur. All extraneous sources of sugar being removed, there would be simply body glycogen and body protein to draw upon for the formation of sugar, and experiments on diabetic animals show that carbohydrate is better utilized when the needs of the body are extreme. The chief objection to this course is acidosis which must certainly result, and might prove alarming. Naunyn introduced starvation days to render patients sugar-free when other methods failed.

The total exclusion of carbohydrate and protein, and subsistence on vegetables and fat (von Noorden's vegetable days), would, in the majority of cases, at once free the urine from sugar. Such a method at the beginning of treatment is open to greater objections than the starvation method, because the increased quantity of fat might upset the digestion of the patient.

The complete exclusion of carbohydrates at the onset of treatment is the third most rapid way of rendering the urine of the patient sugar-free. I have always had serious objections to such heroic measures, but, with increasing knowledge regarding acidosis, I believe it may frequently be employed, providing its dangers are thoroughly appreciated. Patients and physicians often claim that they inaugurated such treatment when the disease was first diagnosed. Investigation usually shows that this was not the case. Either a mistake was made by the patient, or the physician thoughtlessly allowed some such carbohydrate food as milk. I believe this to be the reason why many physicians consider it safe to at once institute an exclusive protein fat diet.

The advantages attendant upon the sudden introduction of a protein fat diet are, first, that the patient is encouraged by his urine being quickly freed from sugar, and not discouraged by a progressive curtail-

ment of the diet. Second, the urine is so quickly freed from sugar that the reserve of glycogen in the body is not seriously drawn upon, and yet sufficient carbohydrate-forming material, derived from protein or stored glycogen, is oxidized to prevent severe acidosis. Third, the period of the strict protein fat diet is very short, and the patient is allowed additional carbohydrate within a few days because of his increased tolerance for the same.

The disadvantages of the sudden introduction of the protein-fat diet are, first, the mental effect upon the patient. This is due to the great quantity of fat which he finds he must eat to maintain body nutrition, and he is discouraged by the narrowness of the protein-fat diet. Second, undernutrition is almost an unavoidable consequence of a protein-fat diet. This may be advantageous, as has been said, for starvation will render the patient sugar-free. On the other hand, the inanition may be so great that it is difficult for the patient to regain the weight later on. A loss of more than two to three kilos during the inauguration of any diabetic diet is unjustifiable, unless we are dealing with diabetes combined with obesity. Third, indigestion may appear, and in a severe case would prove serious because of the inanition which it entails. I confess, however, that it is rather unusual for the young or middle-aged diabetic to suffer from disturbance of the stomach or bowels, but it is common in older patients. The occurrence of indigestion may remove the possibility of thorough dietetic treatment for weeks and even months. Fourth, acidosis develops whenever there is lack of combustion of carbohydrates in the body, and is, therefore, sure to follow their sudden withdrawal from the diet. Should indigestion and anorexia or intolerance of the alimentary tract for food develop, the store of glycogen in the body would be soon exhausted, and coma might easily result. Of all the objections to a sudden restriction of carbohydrates, this is the most serious. Fifth, the sudden restriction of diet is unnecessary and, therefore, an unjustifiable risk. Patients with diabetes often come to the physician in a state which is endurable. It is the function of the physician to improve upon this state. Only too frequently treatment does the patient more harm than good, but the fault lies not in the principles of treatment, but rather in their application. The physician who undertakes to treat a patient with diabetes, whose condition is comfortable, resembles the surgeon who, operating for an interval appendix, assumes a responsibility far greater than when an emergency makes such an operation imperative.

The Dietetic Management of the Individual Case.—*Mild Diabetes.*—The diabetic patient, or the individual in the household responsible for his care, must be instructed in the principles underlying the diet, and the aim of treatment explained. The patient must understand that success in treatment lies in full coöperation with the physician. The instant that directions are not followed or errors not reported, treatment of the patient ceases to be satisfactory. Mistakes of diet are often innocently made, and for this reason I ask the patient to send with the urine a list of the food eaten during the day of its collection. It is usually

necessary to impress upon the patient the necessity of regulating the diet, not only qualitatively but quantitatively, and for this purpose scales to weigh some portions of the food are required. The physician does well to loan such, and he will find the loan greatly appreciated. It is seldom necessary for the food to be weighed more than for a few days. Meat and bread are the chief foods which require it. I consider it unwise to insist upon prolonged periods of weighing the food, for the slight accuracy thereby achieved is more than offset by the annoyance caused the patient.

It is always interesting to know the condition of the urine when the patient first comes for treatment, and, whenever I can arrange it in advance, I have the urine and a copy of the diet of the patient submitted to me at the first visit. If this is not feasible, I at once proceed to regulate the diet, and do not advise the patient to continue upon his previous diet another day simply to gratify my curiosity.

It is my custom to place all untreated cases of diabetes, unless of unusual severity, upon a diet in which the carbohydrates have been restricted, to the neighborhood of 150 gm. For such a diet I utilize the diet-chart above recorded, and tell the patient to eat anything recorded upon the chart under the following headings:

	Nitrogen. Gm.	Total carbohy- drates. Gm.
1. Strict diet, including meat, 300 gm., and 3 eggs.....	13	
2. Vegetables in the 5, 6, and 10 per cent. groups.....		10
3. Cream, 250 cc. ($\frac{1}{2}$ pint).....	1.5	5
4. 3 small oranges or grape-fruit.....		30
5. Oatmeal, 36 gm. (1 gill).....	1.	25
6. Bread, 100 gm. ($3\frac{1}{2}$ ounces).....	1.5	55
7. Milk, 500 cc. (1 pint).....	3.0	25
	20.0 gr.	150 gr.

Such a diet possesses several advantages. It is easily obtained by the patient, easily measured, furnishes carbohydrates in simple form, and that form of carbohydrate which in the course of the disease will most probably be not only most acceptable to the patient, but at the same time safest for him to take. Further, it is a diet which contains enough carbohydrate to prevent the appearance of grave acidosis. The patient is also instructed to increase the quantity of butter in the food, to bear in mind the advantage of taking fat meat, and to use salad oil. The urine should be sent for a second examination within forty-eight hours of the adoption of such a diet, and about every two or three days thereafter until free from sugar.

The examination of the urine, after the patient has been upon the diet above mentioned for thirty-six to forty-eight hours, may, but will not necessarily, show whether the patient is of the mildest type of diabetes. Over and over again cases are seen with 5 and even more per cent. of sugar in the urine at the outset, which later become sugar-free, and fall into the group of mild diabetes. On the other hand, the appearance of acidosis in the urine of a patient living upon the above diet shows that

the patient belongs to either the severe or moderately severe type of the disease. The treatment of this latter type of case will be considered later.

Unfortunately, the diabetic patient seldom becomes sugar-free upon a diet containing 150 gm. carbohydrates. Under these conditions I restrict the quantity to 125 gm. by the omission of milk. The loss of the 25 gm. of carbohydrates (actually a smaller amount, for it was not all utilized) is made up by the addition of a tablespoonful of oil, $\frac{1}{3}$ ounce of butter, or a large egg. If sugar still persists at the end of twenty-four hours, one-half of the bread is omitted, and upon the next day the remaining half. If sugar continues to be present, and acidosis absent, the carbohydrates may be restricted again in the next twenty-four hours to 75 gm. by the omission of oatmeal, or by the omission of one-half of the fruit, and upon the next day again restricted by the removal of the remainder of these two groups. The diet then consists of a protein-fat diet, with the addition of about 300 gm. vegetables of the 5, 6, and 10 per cent. groups of the chart, and 250 cc. cream—an equivalent of 16 gm. carbohydrate. Mild cases of diabetes are sugar-free upon this diet.

If the patient does not become sugar-free upon strict diet, with vegetables in the 5, 6, and 10 per cent. groups, and 250 cc. cream at once, he may be kept upon this diet for a few days. If the sugar in the urine successively decreases, we may expect him to become sugar-free within one week, but as soon as it is seen that the sugar ceases to decline, a protein carbohydrate-free day or a starvation day should be instituted. Promptness in the use of such methods is of distinct advantage. The cases of diabetes which do not become sugar-free upon strict diet, with cream and vegetables containing a minimum of carbohydrate, are to be classified dietetically as moderately severe, and their treatment will be described under that heading.

When the patient has once become sugar-free, the greatest pains should be taken to prevent the recurrence of sugar. This is essential, not only because of the effect which return of sugar has upon the mental attitude of the patient, but also because of the greater difficulty in subsequently rendering the urine sugar-free. Having become sugar-free, the patient should maintain the same diet for one or two weeks. If cream has been omitted, this rule will hardly be broken if a little cream is allowed on the second or third day following the first sugar-free day, and the daily addition of a teaspoonful of cream for this period. The quantity of carbohydrates in 250 cc. cream is only 6 gm., and the caloric value of this amount of cream is not far from 600 calories—nearly one-fourth of the total ration. The patient thus gains hope of subsequent increases in the diet. Next to cream, I consider half a grape-fruit the most advantageous addition to a rigid diet. The weight of the edible portion of half a grape-fruit is about 120 gm. (4 ounces) making the total amount of carbohydrate in the same 6 gm. I do not remember of a patient who was able to tolerate one-half pint of cream who could not tolerate the addition of half a grape-fruit. A patient causes me no anxiety for fear of loss of nutrition, who is free from sugar upon strict diet, vegetables

in the 5, 6, and 10 per cent. groups, 250 cc. cream, and half a grape-fruit. The composition and caloric values of such a diet are recorded below.

Substance.	Quantity.	Carbohydrates.	Fat.	Protein.	Nitrogen.	Calories.
Cream.....	250 cc.	6	50	9	1.5	600
Vegetables, 5, 6, and 10 per cent. groups.....	300 gm.	10	..	..	..	40
Grape-fruit.....	120 "	6	..	..	..	25
Butter.....	120 "	..	102	..	..	960
Oil.....	15 "	..	15	..	..	270
Bacon.....	30 "	..	15	..	..	135
Meat or fish cooked....	300 "	..	15	62	10.0	475
Eggs.....	3 "	..	15	20	3.0	225
		22	212	91	14.5	2730

Most patients can maintain such a diet indefinitely. Half an orange may be substituted for half a grape-fruit. With children I usually begin by allowing one compartment of an orange, and gradually work up to the half. It will be seen that such a patient is taking approximately 20 gm. of carbohydrates.¹ Subsequent additions to the diet should be made at the rate of about 5 gm. weekly. This enables the system to better recover from the presence of an excess of sugar in the blood, to attain a better tolerance, and also trains the patient to live upon a plain, yet strict, diet which is everywhere obtainable. For this reason, at the beginning of treatment, I never allow substitutes for bread or sugar-free delicacies. This is especially necessary for poor people.

Subsequent additions to the diet depend somewhat upon the desires of the patient, but usually take the form of fruit, oatmeal, or, in the case of children, milk. It is a good plan to make these additions in a single direction, so as to test the patient's capacity for the different carbohydrates, fruit (levulose), oatmeal (starch), and milk (lactose). In no instance do I think it wise to push either variety of carbohydrate to a greater degree than the patient cares to take permanently. Even with children it is seldom wise to increase the milk to more than 1 pint. It is an old precept in diabetic treatment that, when a moderate amount of one variety of carbohydrate is tolerated, another carbohydrate may very likely be added without harm. I think a gill of oatmeal—dry weight, 36 gm., equivalent to 24 gm. carbohydrates—the best addition to the diet, because it is a vehicle for cream. As a rule, the milk is not borne as well as the oatmeal or fruit, and usually subsequent additions to the diet take the form of potato or bread. One may allow exchanges in the diet between the different forms of carbohydrates, but not until the patient is thoroughly trained.

No addition to the diet of a diabetic patient should be made without a subsequent test of the urine. If the urine gives a suggestive, but not a positive, reaction for sugar, an addition to the diet, however small, is generally followed by a definite reaction.

The milder cases of diabetes after several weeks attain a tolerance of

¹In dietetic calculations I compute the carbohydrates only to the nearest 5 gm.: 5 in 250 cc. cream, 5 in one-half grape-fruit, and 10 in 300 gm. vegetables of the 5, 6, and 10 per cent. groups.

more than 100 gm. carbohydrates. In these cases it is unnecessary to restrict the diet beyond the point at which the urine becomes sugar-free. Such cases should restrict the quantity of carbohydrates in their diet for years, even though no signs of sugar appear. It is interesting to note that many of these patients feel better and have less digestive trouble if the quantity of carbohydrates is limited to about 125 gm., even though they tolerate more. Such individuals live apparently in perfect health, and there is always satisfaction in the belief, and I think justification for it, that treatment has prevented the progress of the disease.

Moderately Severe Diabetes.—The treatment of many of the patients in this group is essentially the same as that of the mild diabetic, but for the remainder more vigorous dietetic measures must be employed to render the urine sugar-free. There are three such measures at our disposal—the moderate reduction of protein, vegetable days, and starvation days. Of these, the reduction of protein is the least exacting, and should be made when the sugar in the urine fails to fall equally with the lowering of the carbohydrates of the diet, or when the patient has remained for a few days upon a strict diet and green vegetables, and yet has failed to become sugar-free. In fact, this has been partially accomplished, for the nitrogen in the original diabetic diet was 20 gm., and the nitrogen in the carbohydrate-free diet about 15 gm. This quantity may be lowered for a few days to a diet containing only 8 or 10 gm. of nitrogen by restriction of meat or eggs. I consider 30 gm. of uncooked meat equivalent to one egg, which contains 1 gm. nitrogen. If this does not result in the disappearance of the sugar from the urine, I at once institute a carbohydrate-protein-free day, *i. e.*, vegetable day, which is almost invariably successful. The technique of the day following a vegetable day should differ from it only by the addition of 50 gm. protein (8 gm. nitrogen). Subsequently, this quantity can be gradually raised, and at the end of a week a moderately severe case of diabetes should be able to tolerate a diet containing 13 gm. of nitrogen and 50 to 100 cc. cream. From this point onward the diet should be very gradually increased, invariably controlling the effect of an increase in the diet by urinary tests. Too great pains cannot be taken to prevent a return of the sugar in the urine. For this reason it is wise to make the diet upon one day each week considerably lower in carbohydrate, and often in protein as well, than upon the other days.

Patients below the age of fifty will very likely bear additions of protein to the diet better than additions of carbohydrate, but above that age moderate quantities of carbohydrate may be tolerated better than excessive quantities of protein. The diet of the diabetic patient of moderate severity is preëminently an experimental diet and each case is a law unto itself.

The restriction of protein in the treatment of diabetes is serious, not so much because of its caloric value, but because protein is indispensable, and quite likely is the food which the severe diabetic most readily oxidizes. Finally, its restriction lowers the quantity of protein metabolized, and thus the quantity of ammonia available for neutralization of acids. Such restriction should be adopted only with the closest supervision, and

with the greatest possible caution in patients who are undernourished or past middle life.

Protein- and Carbohydrate-free Day; Vegetable Day.—Such a day is best employed when the sugar in the urine is 1 per cent. or less. The vegetable day is a day of undernutrition, and consequently the patient should remain in bed and thereby save a few hundred calories. The protein-carbohydrate-free day in the second place is a fat and vegetable day. The vegetables constitute the bulk of the diet, but the fat its nutritive value. In selecting vegetables for such a day, limit the variety. Patients should become accustomed to eat a large quantity of one vegetable rather than a small quantity of several vegetables at a meal, because thereby variation in the diet is better secured. The vegetables must be especially prepared for the diabetic by having the water used in cooking changed several times, both to remove carbohydrate and to render them better butter carriers. The best vegetables for such a day are lettuce, spinach, string-beans, and cabbage. Other vegetables from the 5 and 6 per cent. groups may be employed, but to a less extent; thus, cucumbers are too apt to disturb the digestion. Besides the vegetables, coffee, tea, bouillon, and broths are allowed. Some writers add yolks of eggs to such a diet, but I believe this unwise, and I strongly discountenance an egg-vegetable day, in which the yolks of a dozen or more eggs are given the patient, because thereby he may become averse to taking any in the future. Bacon is allowed, as is also very fat ham. I never count bacon as containing protein. It is advantageous to employ more alcohol than the usual diet includes.

Severe Diabetes.—Cases of severe diabetes may be divided into severe and extremely severe groups. The former are to be treated in a manner similar to that outlined for the treatment of the mild and moderately severe types, only the same methods are to be carried to further extremes. For this class of cases a starvation day, as recommended by Naunyn, may be the final act in freeing the urine from sugar. It is the very exceptional case of moderately severe diabetes which does not become promptly sugar-free after a vegetable day. And, though it is possible for a case to be moderately severe, and yet not to become sugar-free, in what is now said regarding the use of the starvation day reference will be had chiefly to the severe type of diabetes.

Starvation Day.—While the aim in diabetes is to render the patient sugar-free, frequently this goal must be abandoned for various reasons, chief among which is the development of acidosis. If this has not appeared until the carbohydrates have been nearly eliminated, or if the acidosis is of moderate extent, it may be safe to institute a starvation day. During such a day the acidosis does not increase and may fall. This is due perhaps to the disintegration of body protein, from which carbohydrate material is furnished, which the organism under stress of need burns. The starvation day, however, should be employed only when the patient is under the direct observation of the physician, and only when the physician from his knowledge of the case feels assured that he can control the acidosis which previous restrictions of diet have pro-

duced. Such a day is comfortably borne by the patient, he is not particularly hungry, does not particularly dislike the rest in bed, and the results of it are in many cases surprisingly good. It is seldom, however, that the patient becomes sugar-free unless the quantity of sugar in the urine has been below 1 per cent. the previous day. The patient may be allowed beef-tea, broths, coffee, tea, and alcohol. Upon the following day a return is made to the preceding diet, and from then on the diet gradually increased.

The future management of these severe cases now depends chiefly upon the acidosis. If this is extreme, the diet should be increased steadily by 10 to 15 gm. of carbohydrate daily, up to about 50 gm. On the other hand, if the acidosis is considerable, and yet the patient is under such close observation that the physician can daily estimate the variations in it, it may not be necessary to increase the carbohydrate at once, and the patient is thus given one more chance of becoming sugar-free. The use of oatmeal upon such occasions will be later described. The easiest time to get a diabetic patient sugar-free is when he first comes for treatment, and I always give up the attempt with great reluctance.

The course which must usually be adopted with the severest cases of diabetes is dictated by the extent of acidosis and by the weight. When the acidosis is considerable (measured by the elimination of 5 gm. ammonia, 20 gm. or more of β -oxybutyric acid, or failure after several days to render the urine alkaline with 24 gm. sodium bicarbonate) I believe that the diet of the patient should contain 50 or more grams of carbohydrate. The upper limit for carbohydrate for such a patient would not exceed 125 gm., except in those extremely severe untreated cases, who are accustomed to eat enormous amounts of carbohydrates for years. Such patients show at once a marked acidosis upon a diet of 150 gm. carbohydrates. It is as important that the diet of these patients should include 200 gm. of carbohydrates as it is for the ordinary cases of diabetes to exclude this quantity. The treatment of this special type of case consists in improving the nutrition by the addition of fat. But the quantity of carbohydrates allowed should be as accurately controlled as when a minimum of carbohydrate is given. By this means one never loses touch with the case, and some loop-hole may develop through which the diet may be improved. Unless an accurate control is kept, the patient loses hope and feels that his doctor has given him up. This feeling is not justifiable for either patient or doctor, because these severe cases are often the most satisfactory. Any loss of weight must be energetically combated in severe diabetes, and the means at our disposal are the introduction of more food and rest. Such individuals seldom show the depression in spirits which untreated patients show, and often maintain their capacity for mental work. It is true that the patient is more nursed than treated, as Naunyn has said, but the nursing is none the less satisfactory. Occasionally in the course of treatment recourse should be had to days of starvation or vegetable days, but, as a rule, it is best not to interfere with the even tenor of the diet. The actual management of the acidosis will be taken up in a separate section.

If in the course of treatment the patient becomes languid or depressed, a careful study of the case will determine whether these symptoms come from an increasing acidosis or undernutrition, and the physician must be governed in the future treatment accordingly.

The Use of Oatmeal.—The use of oatmeal in diabetes is still *sub judice*. It was thought at first that the oatmeal would be of value in a great many cases, but in the course of time its use has been gradually restricted to individuals of the severe type. In some of these the apparent effect is really marvelous, and I cite Case 289.

Case 289

Date.	URINE			DIET						
	Volume Cc.	Diacetic acid.	Urine— Sugar gm.	Carbo. —Gm.	Protein Gm.	Fat Gm.	Alcohol Gm.	Carbo. Bal. Gm.	NaHCO ₃ Gm.	Weight Kilos.
Oct. 10 to 11..	2640	+++	..	19	80	200	6	—55	32	53.1
Oct. 11 to 12..	2940	++++	29	13	15	255	6	—15	32	53.8
Oct. 12 to 13..	3540	+	39	120	30	150	9	+80	32	52.9
Oct. 13 to 14..	3360	+	64	180	50	270	9	+115	32	53.3
Oct. 14 to 15..	2880	+	25	13	70	200	9	—10	32	54.1

REMARKS

October 10th to 11th: 2 eggs, 240 gm. meat, 30 gm. cheese, 375 cc. cream, vegetables.

October 11th to 12th: Vegetable day—300 gm. butter, 90 cc. cream, broths, vegetables.

October 12th to 13th: Oatmeal day—180 gm. oatmeal, 165 gm. butter, 90 cc. urine.

October 13th to 14th: Oatmeal day—270 gm. oatmeal, broths, coffee, 90 cc. wine, 320 gm. butter.

October 14th to 15th: 200 gm. meat, 3 eggs, 120 cc. cream, 90 gm. wine, 165 gm. butter, vegetables.

It will be seen that while the carbohydrate in the diet upon the oatmeal day was greatly in excess of that in the control days, only a comparatively small portion was eliminated and the acidosis measured by the diacetic acid was lowered. At first sight one would credit the oatmeal with a marvelous effect, but, before accepting such a miracle, investigation is needed along three lines—the determination of the respiratory quotient, the analysis of the percentage of sugar in the blood before and after the oatmeal is taken, and the subsequent excretion of sugar. I shall withhold a final opinion upon the oatmeal treatment until experiments in the respiration calorimeter and of longer duration have been conducted with oatmeal. As to the quantity of sugar in the blood before, during, and after the oatmeal treatment, enough data are not at hand, but von Noorden records 0.19 per cent. of sugar in the blood upon an oatmeal day, although the urine was sugar-free. Finally, the sugar formed from the oatmeal may be later excreted. My cases show evidence of such excretion, but the figures are not as striking as those of von Noorden. He records a patient who showed no sugar in the urine upon two vegetable days, followed by three oatmeal days, and yet in the next three vegetable days, 96, 106, and 22 gm. sugar respectively were excreted. The retention of nitrogen upon oatmeal days also suggests a retention of carbohydrates, as does also the appearance of œdema during the oatmeal period. I cannot speak definitely about the

effect of oatmeal upon the acidosis, but von Noorden believes the same to be greatly reduced.

The original method proposed by von Noorden for administering the oatmeal, combining with it a considerable quantity of protein in the form of vegetable or egg-albumen, was later modified by the elimination of most of the protein. Still later, von Noorden limited the number of oatmeal days from upward of a week to two or three days, and preceded and followed the oatmeal period by several days of strict diet followed by vegetable days.

His present method is as follows:

For several days a strict diet is instituted, and by strict diet is meant a diet made up of articles of food included under strict diet in my chart, and vegetables in the 5 and 6 per cent. groups, with the addition of about 250 cc. cream. After these days come two or three vegetable days, upon which from 2 to 6 eggs are allowed. Three to four oatmeal days follow; 250 to 300 gm. (dry weight) of American oatmeal are thoroughly cooked, and before serving, 250 to 300 gm. of butter are added. The oatmeal is taken by the patient in portions every two hours, either as gruel or porridge. Occasionally 100 gm. vegetable protein (Roborat, Glidin, Tutulin) or 5 to 8 eggs are simultaneously prescribed. Following the oatmeal period are two or three vegetable days, to be succeeded by a period of strict diet with lowered protein. The only other articles of food upon oatmeal days are coffee, tea, lemonade, and alcohol.

The oatmeal day furnishes a day of considerable nutriment.

Substance.	Quantity.	Carbohydrate.	Protein.	Fat.	Alcohol.	Calories.
Oatmeal.....	270	180	40	..	..	880
Butter.....	270	..	..	230	..	2070
Whisky.....	60	..	..	..	30	210
		<u>180</u>	<u>40</u>	<u>230</u>	<u>30</u>	<u>3160</u>

There is no danger, therefore, of undernutrition, and an increase of acidosis is unlikely because of the large quantity of carbohydrate. There is some danger of the possibility of gastric or intestinal disturbances. The patient may vomit, and vomiting is always serious in severe diabetes. The patient may have diarrhoea, and, unless this is quickly overcome, it is as dangerous as vomiting, because it is usually accompanied by anorexia with accompanying inability to take alkalies, and loss of body fluid—a grave sign. Von Noorden overcomes the danger of diarrhoea by prescribing moderately small doses of opium. I must acknowledge that I have not carried out the oatmeal treatment over a period of as many days as von Noorden prescribes, but I have used it with apparent success, limiting the oatmeal period to two days.

It occasionally happens that a patient likes oatmeal to such an extent that he is willing to live upon it for weeks or even months. I have seen one such patient. Upon this diet he did very well, and I am positive that a man past fifty, who could be content with such a diet, would be far safer upon it than upon a diet with much protein and a small quantity of carbohydrate. Unfortunately, such cases are rare.

The introduction of oatmeal in this wholesale manner has stimulated its use in smaller quantities, and I believe it to be one of the most valuable additions to the strict diet of diabetic patients. It can be given in so many different forms, it serves so well as a vehicle for butter and cream, and, finally, is so useful as gruel in the treatment of indigestion.

Use of Milk.—There is no question about the value of milk in diabetes. It would be practically impossible to maintain the diet of a diabetic patient upon a minimum of carbohydrate without cream, and cream is the first form of carbohydrate which I give a patient after he has become sugar-free. Milk is especially valuable for children, and if they can acquire a tolerance for a pint of milk and cream, the balance of the diet is easily arranged.

The value of milk as an exclusive diet usually consists in its being an undernutrition diet, and such a diet is often advantageous because the carbohydrate is better oxidized. Upon a milk diet all the carbohydrate is given in a single form, and many physicians who have had large experience with diabetes believe the carbohydrate to be better assimilated under these conditions than when given in several forms.

Case 17 is the only one in my series which has shown an exceptional tolerance for milk: Male, teacher, onset of diabetes at the age of fifty-five; came under my observation, at the age of sixty, in August, 1900. Upon a diet of 3000 cc. milk, containing 150 gm. carbohydrate, which he had employed with only trifling additions for a period of six weeks, the sugar in the urine was only 13 gm. I endeavored to make him sugar-free, and reduced the carbohydrates in the diet to 25 gm., but the sugar in the urine fell only to 9 gm. During the previous six weeks his weight had only fallen 1 kilogram, and I am sure it would have been far better for the patient if I had added a little fat or alcohol to the diet than to have attempted to render his urine sugar-free, especially because he was past middle life. One should always be on the watch for such cases, and take advantage of any favorable idiosyncrasy of patients for milk.

Various substitutes for milk have been employed. An artificial milk is easily made by diluting cream with three volumes of water, thereby reducing the percentage of fat to 5 per cent., and the sugar to one-half of 1 per cent. The addition of the white of one egg for each 30 cc. of cream thus diluted maintains the proper quantity of albumin. The milk should then be flavored with salt and saccharine according to the taste of the patient. Such a milk should be thoroughly stirred before serving, or else the fat collects at the top of the glass. It is quite palatable. Williamson mixes the cream with water, allows the mixture to stand, and uses the top for the preparation of milk. The sugar by this means is nearly wholly removed. Artificial milks are prepared by various concerns, and I can testify that in one severe case of diabetes, when a gastro-intestinal upset occurred, such a milk was of the greatest advantage in maintaining the patient's nutrition and preventing coma.

The fermented milks contain about half as much carbohydrate as ordinary milk. The alcohol in them is of distinct advantage.

All preparations of milk have this disadvantage, that they contain considerable quantities of casein, and it will be remembered that casein is the one form of protein which is particularly ill-borne by the diabetic patient.

The Use of Potato.—Much that has been said about the use of oatmeal and milk applies to the use of potato in potato cures. A potato diet is an undernutrition diet, contains little protein, and the carbohydrate is administered in one form. Herein alone are its uses. Potato is a good vehicle for butter and cream, and in this respect equals oatmeal, but it is not quite as agreeable to patients as oatmeal. It is a bulky food, and so gives a satisfying feeling to the patient, which is often lacking when upon a strict diet, unless great care has been taken that it contain many vegetables. I have had little experience with potato, but in one case in which it was employed, neither from the analysis of the urine nor from the determinations of the respiratory quotient was there evidence that it was assimilated any better than oatmeal.

In small quantities potato, like oatmeal, is most valuable. It carries butter well, contains only about one-third the quantity of carbohydrate, and is easily measured. A potato the size of an egg weighs about 60 gm., whether cooked or uncooked, and contains 12 gm. carbohydrate.

Practical Points.—The responsibility of the management of the diet of the diabetic patient should always rest upon one individual. As a rule, that individual is the patient, but at other times a member of the household. I think the reason that the treatment of diabetic children proceeds so uniformly is because this responsibility is deeply felt.

The accurate control of diabetic patients in the open wards of hospitals is impracticable. The labor entailed on the part of the nurses in the preparation of an accurate diet, and the time involved in the analyses of the urines, are so great that they are not worth while, in view of the fact that the patients so often either purposely or by accident break the diet or lose the urine. On the other hand, private patients who are paying their own expenses at a private hospital realize the value of the treatment more acutely, and can be trusted almost absolutely to follow instructions, even though other patients are in the same room. A temporary residence at a private hospital is desirable at the beginning of treatment, but I have had many cases who carried out my instructions quite as accurately at home. A prolonged stay at a hospital is undesirable, because patients lose their appetite.

A diabetic patient should always be told what to do in emergencies for food. He can almost always obtain eggs, cheese, bacon, butter, and coffee, and with these maintain a strict diet for one or two days. On the other hand, it is quite as important for the patient to understand that he is to take milk, oatmeal, or other carbohydrate at once if a severe upset of the digestion occurs, so as to avoid coma from undernutrition.

I always tell a patient *what* to eat, for the chances are that previously emphasis has been put on what *not* to eat.

The breakfast of the diabetic patient is usually best made up of coffee, eggs, bacon, and, if it is allowed, oatmeal. Dinner, the hearty meal,

should contain the least quantity of carbohydrate, because at this meal there are more vegetables and a greater variety of food. At the third meal, whether at noon or at night, a cooked vegetable or a salad must be provided, and with meat or fish, tea or cracked cocoa, and the remaining carbohydrate, enough variety is obtained. This is the meal for the diabetic delicacies or the odd articles of food which taken occasionally are a relish. It has been my experience, in the milder cases of diabetes, that carbohydrate was less well borne at noon than at any other time of the day.

The Treatment of Acid Intoxication.—The treatment of acid intoxication lies in its prevention, and the chief weapons at our disposal are the administration of carbohydrates, the use of alkalies and of fluid to remove the acids from the body.

The normal body contains approximately 400 gm. of glycogen, and the diabetic organism far less. Whenever undernutrition appears from whatever cause, this small store of carbohydrate-forming material must be rapidly depleted. Were the patient to rely on the oxidation of this alone to prevent acidosis, the sword of Damocles would be held by a slender thread. Fortunately, in addition to a little glycogen, he has in the catabolism of body protein another source of supply. This is not inconsiderable; thus, Case No. 4 in coma catabolized 23 gm. of nitrogen in one day. This is equivalent to the catabolism of about 150 gm. protein, and from this quantity of protein it is possible that 120 gm. carbohydrate may be secured. Although the severe diabetic patient may oxidize only a portion of the carbohydrate thus formed, it is quite conceivable that he may oxidize sufficient to offset a considerable portion of the acidosis. To offset the remainder he must depend upon carbohydrate in the food and upon alkalies.

Acid intoxication need not be considered in the mild cases of diabetes. In the moderate cases with the restriction of carbohydrate it will probably appear, but if, from the behavior of the patient and from the carbohydrate balance, the case is seen to be progressing favorably, it is perhaps best neglected. It should not be neglected if there is the slightest doubt in the mind of the physician. Under these circumstances the appearance of a positive ferric chloride reaction should at once raise the question of the future treatment. There should be no hesitation in continuing the plan of getting the patient sugar-free, unless the course of treatment thus far has been badly borne, but alkali should then be given, and in considerable quantity. If the condition of the patient improves, there need be no letting up in the plan of treatment, but if in doubt, go up in the scale of carbohydrates just as if the urine had been made sugar-free. Falta told me that in his experience it was more advantageous for the alkali to be given in comparatively large doses at the start,—30 gm. or more,—rather than to gradually increase it. In his judgment the urine of the patient was made more quickly alkaline in this way. If the urine is alkaline, one feels safe, but one also feels safe if the patient shows a positive carbohydrate balance, or only a very small negative carbohydrate balance. The alkali should be continued while the patient is upon

a very restricted diet, but in these moderate cases may be gradually lessened, even though the reaction of the urine is strongly acid. In other words, the determination of the quantity of alkali to be administered may rest not only upon the tests for acidosis, but also upon the carbohydrate balance and the condition of the patient. If quantitative tests for acidosis (*i. e.*, for β -oxybutyric acid or ammonia) can be made, the physician feels more at ease about the patient, but I always consider the days upon which the patient is just becoming sugar-free on a very restricted diet *as the critical period in the dietetic management of diabetes* and rejoice when they are over. The severer the type of diabetes and the older the patient, the shorter the time he should spend upon a strict diet. H. W. Goodall and I found that children or adults under forty years of age tolerated an acidosis, estimated in terms of 4 to 5 gm. of ammonia, far better than older persons bore an acidosis represented by 2.5 to 4 gm. ammonia. This was due, in our opinion, to the greater vulnerability of the kidneys of old people. Healthy kidneys readily excrete the acids, but impaired kidneys do this with difficulty, and I have more than once observed a trifling acidosis in such subjects lead to serious results.

In the severest type of diabetes the acidosis may be extreme, reaching a figure represented by the excretion of more than 60 gm. of β -oxybutyric acid in twenty-four hours. In such cases I feel compelled to give in the neighborhood of 100 gm. of carbohydrate daily, and in addition as much sodium bicarbonate as the patient will well stand. As a rule, patients of this character show this degree of acidosis temporarily, and it soon diminishes to the neighborhood of 30 gm. β -oxybutyric acid daily. The alkali may then be reduced to 24 gm. daily. I dislike giving more alkali than this continuously, for fear that the patient will acquire an aversion to it, or his stomach become intolerant, and he is then put in jeopardy. The alkali is best given after meals. It may be dissolved in cold Apollinaris or in Vichy (Celestin), a quart of which contains about 4 gm.

The onset of coma can often be anticipated when inanition, gastrointestinal disturbances due to whatever causes, or exercise make too great drafts upon the body glycogen. Treatment here is repeatedly successful, and consists in the administration of an easily assimilable carbohydrate, such as oatmeal gruel or milk. Large doses of alcohol in the form of wine, whisky, or brandy may be employed, and v. Noorden has found the use of alcohol especially advantageous if all other foods are withheld. The maintenance of the stomach of the patient in good condition is so important that these foods should be administered in quantities of not over 100 to 250 cc. every two hours, and always should be given slowly, preferably with a teaspoon. This applies especially to milk, since milk curdles so rapidly. It is best not to give cream. Simultaneously alkali may be administered, and as much as possible. Usually one can give 4 gm. of sodium bicarbonate for two doses at thirty-minute intervals, but later it is better to drop to three-quarters of an hour or longer intervals, to prevent indigestion. The alkali can be given with water, but, as these patients, left to them-

selves, drink enormous quantities of water, the amount taken should be closely supervised. Only in this way will acute dilatation of the stomach be prevented. Once this has occurred, all hope goes. I am in the habit, at the merest suggestion of coma, to order enemata of salt solution (*not* sodium bicarbonate) by the drop method. In this way 1 to 4 liters of fluid may be introduced into the body in twenty-four hours, and the stomach greatly relieved. Large quantities of water are essential for the elimination of acid salts. β -oxybutyric acid practically never leaves the body in a greater concentration than 1.5 per cent., and few patients ever recover from diabetic coma who are unable to void 10,000 cc. of urine in twenty-four hours.

The treatment of coma is most unsatisfactory, and when this is well established, I have not the heart to seek to bring the patient out of it for a few hours, days, or even weeks by radical measures. There is one exception to this statement. A patient with diabetes untreated by alkalis, who suddenly develops coma due to great restriction of carbohydrates in the diet, might well be the subject for intravenous injections of alkali. When such are given, the alkali had best be administered in the form of a 3 per cent. solution of sodium bicarbonate (1 ounce to a quart, 30 gm. to a liter), dissolved in normal salt solution. It should be added to the salt solution after the latter has been sterilized, for if added before, it is partially decomposed. I have given 1500 cc. of such a solution several times to a patient, with the result that he came out of coma, only to again relapse into it. The case, however, was one which had been treated with large doses of alkali for months. Young individuals are much better adapted to such treatment than older patients, because of the susceptibility of the kidneys of old people to the action of β -oxybutyric acid.

The Conservation of Energy in the Diabetic Individual.—The severe diabetic loses much energy through unoxidized products in the urine, by increased metabolism and lack of a protective layer of adipose tissue, and so every effort should be made to prevent this waste. The treatment above outlined seeks to avoid losses in the urine of sugar and acid products. There is another loss, not generally appreciated. Patients drink cold water, and this must be raised to the temperature of the body. The amount of energy expended in warming this water is considerable; thus if 3 liters at 10° C. are drunk, the temperature will be raised 27° C., and for this 81 calories are necessary. One cannot force diabetic patients to always drink hot liquids, but one can caution them in this regard. Loss of body-heat should be prevented by warm clothing, and the patient should not be exposed to extremely low temperatures. Rapid reductions in body-heat, which occur in automobile riding or in cold baths, should be prevented.

Loss of energy should be prevented by limitation of exercise. While exercise may favor the oxidation of carbohydrates, there is always danger that the exercise may be overdone. Even cases of moderate diabetes should not enter into contests, or place themselves in other situations where they cannot instantly rest if the need is felt.

The Use of Drugs.—Drugs may be very beneficial in the course of treatment of a diabetic case, just as in any chronic disease, but not because of any specific action upon the diabetes. Nevertheless, scores of drugs have been employed with such a purpose. I use none of them. The older writers consider opium with its derivatives and aspirin the best.

Opium may decrease the sugar in the urine if it has already fallen to 1 per cent. or less, but it does not raise the tolerance of the patient for carbohydrates. The action of opium has been explained by its delaying the passage of carbohydrate food through the alimentary tract; in consequence, absorption goes on more slowly and there is better assimilation. I have employed opium in two or three cases, and, though I have often seen it used by other physicians, I can truly say that I have never seen a case of diabetes in which I have felt that its use was beneficial. Case No. 10, male, bank teller, came to me in October, 1899, with the history of sudden onset of diabetes at thirty-nine years of age, in March, 1898, while on an important financial trip to New York city. The urine contained 8.1 per cent. sugar, and with moderate restriction of carbohydrates showed four days later a moderate ferric chloride reaction and 3.4 per cent. sugar. For weeks previous to his visit to me he had taken large quantities of opium, and was in a most deplorable condition, until he gave it up of his own accord. He became sugar-free only for a few days, but in the intervening twelve years he has not only continued his occupation, but been promoted to the position of cashier, only giving up work in 1909 upon development of mild signs of pulmonary tuberculosis. The utter impracticability of treating such a case for twelve years with opium is obvious.

Aspirin is still less advantageous than opium, for, though it may be taken with little discomfort for a short period of time, after weeks it certainly disturbs the digestion. It does not build up a tolerance for carbohydrates. I cannot acquire enough enthusiasm for the other drugs to even narrate them. Any one wishing to use these had best consult books written from ten to fifty years ago.

Saccharine is a distinctly helpful substitute for sugar. I have never seen any harm from its use, and often much benefit. It is best to advise the patient to render foods less sour with saccharine than to make them sweet, because the sweet taste persists. Foods should not be heated after the addition of saccharine, as they thus acquire a bitter taste. Various other preparations have been employed instead of saccharine; among these are crystallose and dulcin, and some patients prefer them.

Alkalies.—*Sodium Bicarbonate.*—The preparation used should be pure, because such are far more agreeable. Some patients prefer it in crystalline form, and others find potassium bicarbonate more agreeable.

Calcium Carbonate.—von Noorden is accustomed to give 5 to 6 gm. calcium carbonate along with the sodium bicarbonate.

Complications.—**Tuberculosis.**—Although tuberculosis was formerly a common avenue of death for the diabetic patient, to-day in private practice it seldom occurs. Patients must not be exposed to the disease. Should it develop, in its incipient stages it is amenable to treatment,

and precisely along the lines indicated for the ordinary tuberculous patient. Patients may survive both diseases for many years. Should, however, the tuberculosis gain the upper hand, it is wiser to allow a moderate supply of carbohydrate. Dietetic treatment of the diabetes should never wholly be sacrificed even in advanced consumption, because the complications of untreated diabetes far outweigh the burdens of the diet. Not infrequently toward the end of the disease the sugar decreases, or even disappears, due to malnutrition.

Diabetes and Surgery.—Surgical operations can be performed upon diabetic patients far more successfully than was the case before the introduction of asepsis and modern methods of narcosis. The rule, however, still holds good that surgical operations upon diabetic patients should be avoided whenever possible. Whenever delay is *not* dangerous, it is wise to defer surgical interference, for it is surprising how many apparently severe conditions improve when the patient has been put upon appropriate treatment. In case, however, the patient has been under such treatment for a considerable length of time, or in case an operation is deemed imperative, favorable results, so far as the diabetes is concerned, will in most cases ensue if precautions are taken.

Wounds heal better if the urine is sugar-free, which usually, though not always, indicates little sugar in the blood. Therefore, if the case is not urgent, the patient should be treated as any case of diabetes, according to its severity, and then operated upon in as nearly a sugar-free condition as possible. I should not wish to keep the patient upon a diet containing only 30 gm. of carbohydrate for more than two or three days prior to an operation, because a diet so low in carbohydrate would provoke acidosis. Patients with severe diabetes, or elderly patients, should be subjected to slight dietetic changes preceding an operation. The acidosis is quite as dangerous as the sugar. It is, therefore, wiser to operate in the presence of a little sugar rather than in the presence of considerable acidosis.

The operation should take place early in the morning, following as closely as is safe the last meal. Temporary starvation is thereby avoided, and one cause of acidosis eliminated. Similarly, after the operation, the patient should be cautiously fed at the earliest moment with oatmeal gruel or milk up to his known limit of tolerance. For the few days prior to the operation administer sodium bicarbonate in 15 to 25 gm. daily doses, according to the severity of the case, but, if by any chance this disturbs the stomach, omit the alkali, rather than run the risk of even a temporary starvation with its accompanying acidosis. Water should be given freely, both prior to and following the operation, recourse being had to rectal enemata.

Diabetes and Bright's Disease and Arteriosclerosis.—The presence of Bright's disease and arteriosclerosis presents serious complications which are only too frequently encountered in the treatment of diabetes. When these diseases appear many years after the onset of the diabetes, one often finds that the sugar disappears from the urine upon an unrestricted diet. Treatment must then be dictated entirely by the con-

dition of the kidneys and blood-vessels. In other instances the diabetes persists in full force, and there is little hope of improving the condition of the patient. For the intermediate group I believe it advisable to give just as much carbohydrate as the patient will bear, and yet keep the sugar in the urine at or below 1 per cent. Fat is not very well tolerated by such patients, but as much as possible should be taken. The protein in the diet should seldom exceed 50 gm. A strict diabetic diet is ill borne and an acidosis of even slight degree may throw the patient into coma.

Diabetes in Pregnancy.—The number of pregnant women who have sugar in the urine is considerable. So long as the percentage is under $\frac{1}{2}$, or even 1 per cent. there is little cause for alarm. Such patients usually go through to term successfully. Whenever feasible, I have endeavored to get the urine sugar-free, but occasionally this has not been possible, except upon a very restricted diet and this I do not advise in pregnancy. On the other hand, if the quantity of sugar reaches a higher figure, or if the pregnancy occurs in the course of a well-established diabetes, the prognosis is more serious. Such patients should be treated exactly according to the type of diabetes which they represent, and quite irrespective of the pregnancy. It is seldom necessary to interfere with the pregnancy, because nature will take care of that. What has been said regarding surgery and diabetes will apply to the treatment of the patient at delivery. Unfortunately, patients who have sugar in the urine in one pregnancy may show it again in another, and in a greater amount, but this is not an invariable rule. The danger of its recurrence is real, and a patient should be free from sugar for many years before risking the return of symptoms.

Care of the Teeth.—The teeth are often bad in diabetes, but by no means invariably so. I have been impressed with the good results of careful treatment of the teeth, and feel that physicians cannot too strongly advise patients to consult their dentists very frequently.

Care of the Skin.—I am convinced that patients who are carefully treated for diabetes suffer fewer skin complications than untreated cases. Patients should be warned of the danger from slight wounds, should be specifically advised not to allow manicures or chiropodists to draw a drop of blood, and cautioned to report any injury to the skin at once. Pruritus is rare in my experience. It is almost invariably relieved by the dietetic treatment of the patient, and when this does not avail, drugs seldom do. I have never found anything better than the simple zinc oxide preparations. It is astonishing how rapidly improvement occurs in even the severest cases upon an appropriate diabetic régime.

Diarrhoea is best treated by rest in bed from the very beginning to the end of the attack, and a diet consisting of milk, preferably sugar-free, strained, thoroughly cooked oatmeal, and eggs. Avoid undernutrition. Meat given in the form of shaved beef can be soon added, and later cooked vegetables, like spinach purée and stewed celery. Usually rest and the above diet suffice to effect a cure, but this is favored by the use of subnitrate of bismuth, tannalbin, or opium in appropriate doses.

Constipation is the rule in diabetic patients. I have had most success with aloin, $\frac{1}{8}$ gr.; extract cascara sagrada, 5 gr.; phenolphthalein, 1 gr.; podophyllin, $\frac{1}{8}$ gr.; or with mineral waters. Strong cathartics should always be avoided. It is often satisfactory to combine one of the above drugs with a mineral water. Enemata are safer than drugs at the commencement of treatment. It is surprising that constipation should be so frequent in diabetes with a diet containing an excess of fat and coarse vegetables.

Special Diabetic Foods.—The narrow confines of the diabetic diet have encouraged the manufacture of so-called diabetic foods. These are often serviceable, but are to be employed with discretion. Their use should be discouraged at the beginning of treatment. The patient should never be dependent upon special diabetic foods, for they are often unobtainable, always make him conspicuous, and when he acquires a disgust for foods of this class, it is all the harder to abide by the original diet. When the patient buys one of these foods, he is usually given a list of other diabetic foods, and a diabetic diet-list, with resulting confusion in the diet. The patients under my care who have done the best seldom use special diabetic foods. The fifth edition of von Noorden's "*Die Zuckerkrankheit*" contains an exhaustive description of these foods, and a valuable series of analyses by A. L. Winton has been published in the Report of the Connecticut Agricultural Experiment Station, 1906. Reprints may be obtained free by addressing the station at New Haven, Connecticut.

The special diabetic foods may be classed in three groups, substitutes for bread, milk, and sugar, and the last two have been discussed.

Substitutes for Bread.—Most of the preparations upon the market contain as great or greater quantity of carbohydrates than ordinary bread; a few contain less, but the percentage of carbohydrate may vary from time to time. Patients and sometimes physicians forget that substitutes for bread must be prescribed only in definite quantities.

Ordinary bread contains about 60 per cent. carbohydrate-forming material. The bread of one of the largest bakers in Boston upon analysis showed 55 per cent. carbohydrate. Bread made without milk or sugar, but with water and butter, contains 45 to 50 per cent. carbohydrate. Such a bread is undoubtedly superior to many of the different bread substitutes upon the market. Toast is not preferable to plain bread.

There are four types of bread substitutes.

1. *Bran Bread.*—This is no more or less than the use of cellulose, which has no effect upon the metabolism. Bread made of bran alone is not palatable, and even with the use of cream and eggs, or when mixed with flour, it is unsatisfactory. Most patients prefer half the quantity of ordinary bread to twice the quantity of bran bread made of equal parts of flour and bran.

2. *Gluten Breads.*—These breads are made by removing the sugar-forming material from the flour, and it is surprising how thoroughly this can be done. I have often found the percentage of carbohydrate in one such flour under 5 per cent.

3. *Light Breads*.—French bread is often useful, because it is so bulky that it carries much butter. Manufacturers have taken advantage of this idea, and many light breads are on the market.

4. *Aleuronat*, and recently *casein*, have been extensively used to furnish substitutes for bread. Unfortunately, casein is the least desirable protein for the diabetic, and though biscuits made with it contain no sugar, they may work injuriously. In small quantities they are certainly useful.

DIABETES INSIPIDUS

Diabetes insipidus is a disease characterized by the excretion of large quantities of sugar-free urine over a considerable period of time. The weight of the urine excreted in the twenty-four hours may be equal to that of the patient. The disease is often hereditary, but this element has been exaggerated on account of a few striking instances. Magnus-Levy found a slight increase in the oxygen consumption of his patient, but in general the metabolism and health are little disturbed. Aside from the troublesome polydipsia and polyuria, the diminished secretion of water by the skin is the most troublesome symptom. Normal individuals eliminate about two-thirds of the water ingested by the kidneys, and the remainder by the skin and breath, but patients with diabetes insipidus eliminate much more, and wholly at the expense of the perspiration. For this reason, the regulation of the temperature of patients with diabetes insipidus is rendered more difficult, and in certain instances it has risen several degrees in hot weather. On the other hand, as a rule, the temperature is low. The ingestion of excessive quantities of cool liquids favors this tendency, but this is somewhat counterbalanced by the marked diminution in the insensible perspiration.

Diagnosis.—An accurate diagnosis is important, chiefly because of the possibility of confusion with interstitial or amyloid nephritis and chronic pyelitis. The differential diagnosis is easy, because in diabetes insipidus the blood-pressure is not increased or the heart hypertrophied. Confusion with other polyurias is less common and also less dangerous. Examples of such are those due to habit, irritation or stimulation of the kidneys by drugs, and those which occur in convalescence from acute infectious diseases, and in the course of the elimination of accumulations of fluid from the cavities or tissues of the body.

Classification.—Cases of diabetes insipidus fall naturally into three groups—first, those in which there is an organic basis for the disease in the central nervous system; second, those in which a functional neurosis coexists; and, third, the renal type. It is now generally agreed, thanks to the original work of Tallquist and its confirmation by Eric Myer, that the polyuria in the renal type of diabetes insipidus is due to the incapability of the kidneys to secrete a concentrated urine. This loss of power applies chiefly to the salt and urea. The polyuria, therefore, is primary. On the other hand, it has been shown that when the disease is part of a functional neurosis there is no disturbance

in the action of the kidneys, and the polydipsia is the primary symptom. In the remaining type it is probable that polyuria is primary, for, as a rule, lack of power of concentration of the urine has been found when the kidneys have been tested. The behavior of the syphilitic cases is yet to be thoroughly studied.

Treatment.—It is essential that the patient be under strict observation in order to determine the type of the disease and to demonstrate the efficacy of treatment, but no greater mistake could be made than to treat the polyuria alone. The lesions of the nervous system which may underlie the disease are so varied that it is quite within the realm of possibility that surgery may intervene and effect a cure. More commonly syphilis is the cause of the lesion in the nervous system, and the Wasserman reaction should be performed in each case. A positive outcome suggests the appropriate treatment, which often, but not always, leads to successful results. It should not be forgotten that a local tuberculous meningitis may become quiescent, with the resulting disappearance of symptoms.

The general treatment of patients with a functional neurosis is all important, and all those therapeutic measures, such as change of occupation, of climate, and surroundings, should be employed. These patients are the ones most benefited by sedatives or hypnotics. The use of drugs, except as above indicated, appears to be without avail.

The dietetic treatment varies according to the capacity of the kidney of the patient to concentrate urine. As a rule, this is not usually known when the patient first comes under observation, and it is, therefore, safer to test the capacity of the kidney to excrete salt and urea than to limit the total quantity of liquids at the start. The patient is, therefore, put upon a diet which includes a constant quantity of salt and protein. Gradually the salt in the diet is lessened, and later the protein, or, after a few trial days, the patient may be put upon the diet recommended by Tallquist. This is made up of 1000 gm. potato purée, 100 gm. butter, 150 gm. bread, and 500 c.c. tea. In Tallquist's diet the protein, as well as salt, is greatly reduced. If the quantity of urine promptly decreases with the change of diet, it is evident that the patient belongs to the renal type of the disease, or that the disease rests upon an organic basis. On the other hand, if there is no diminution in the quantity of urine, the patient may be considered to belong to the second group.

Confirmation of the test is afforded by noting the results which follow the addition of pure salt or protein to the diet. Of course, the history and physical examination of the patient are likewise taken into consideration.

The quantity of salt in the diet may be reduced for periods of months to the neighborhood of 5 or 6 gm. without harm to the patient. The quantity of protein should not fall below 50 gm., and even at this quantity the patient's general condition should be closely watched. Fortunately there is no necessity of restricting either carbohydrates or fat. Instead of salt the use of spices, vinegar, or lemon-juice may be employed,

and, so far as known, these do no harm. The quantity of salt and protein should be particularly low in the latter half of the day, so that the patient's rest will not be disturbed. Occasionally the lack of power of concentrating the urine does not apply to both urea and salt. This point should be determined, and the patient spared unnecessary restriction of diet. A list of salt-free foods appears in the article upon nephritis, but, in general, such foods are vegetables, fruits, rice, sago, tapioca, cornstarch, fresh butter, eggs, fresh meat, and fish. Indeed, most foods contain little salt; it is the cook who adds this ingredient to our diet.

The type of the disease which has a functional neurosis as its basis can be treated by limitation of the allowance of fluid. This would be dangerous in the renal type of the disease, because concentration of body fluids would result. In order to carry out this treatment the patients must almost invariably be treated in a hospital. They must be educated to drink less. Substitutes for water may be employed, or the patient may be allowed to chew paraffin or gum. The cardinal point of the treatment, however, is the treatment of the functional neurosis which is at the bottom of the disease. As the quantity of urine decreases during the course of treatment of this type of case the specific gravity rises. The restriction of liquids may be rapid at first, until only 5 liters of fluid are allowed in the twenty-four hours. Indeed, it is safe to lower the quantity of liquids to about this amount in any case of diabetes insipidus, for, as a rule, patients of all types are accustomed to drink more than even they actually need.

The results of treatment, along the lines above indicated, thus far have been most satisfactory. Cures are not often effected, but patients live comfortably with unimpaired health for years.

SCURVY

The common occurrence of scurvy in epidemic form and its apparently hereditary transmission suggest an infectious origin, but so far as I am aware all cases reported have been without fresh food, either vegetable or animal, for a varying length of time. This is not true of infantile scurvy, for this may develop while the infant is upon the breast. The disease is frequently preceded by exposure to cold and damp, unsanitary surroundings, privation, fatigue, and despondency. Whereas the disease has grown less and less common in adults, it would appear to be more frequent in children, but improved diagnosis may account for this belief.

Treatment.—The abolition of scurvy was one of the first triumphs of preventive medicine, and to-day few medical students ever see a case.

Prophylaxis consists in providing for an unfailing supply of fresh food, especially fresh fruit and vegetables, in the diet. Fresh meat alone is a sufficient prophylactic as Nansen's three years' polar expedition demonstrated. Lemon-juice or lime-juice (2 ounces a week) were the common prophylactic remedies in former days, but with modern methods

of preserving vegetables and fruits, the variety of antiscorbutic foods is much larger. All the vegetables and fruits are useful, but onions, cabbages, potatoes, and lemons are those commonly employed. The fresh articles are distinctly superior to the canned preparations. It is naturally important that all the foods, fresh or preserved, do not undergo decomposition. Fresh meat-juice is antiscorbutic, and this is probably due to the lactates which it contains. Fresh milk is also antiscorbutic. French and Italian wines likewise possess the same property, as do the infusion of fresh malt and even decoctions of grass, moss, lichens, and fir, and bilberry buds.

Treatment of the Individual Case.—Isolation should be instituted at once, because of the possibility of infection, and all articles capable of carrying infection should be disinfected. If possible, keep the patient in the open air, but if this is impracticable, arrange for an abundance of fresh air and sunshine.

The diet should contain fresh fruits or vegetables. Lemon-juice and orange-juice alone or combined with whites of eggs, grapes or grape-juice, are the forms of food most suitable in the severe cases, but if the digestion is unimpaired, any of the foods considered under prophylaxis will suffice.

The mouth demands much attention because of the condition of the gums. The best treatment of all is cleanliness. Mouth-washes alone are insufficient, and careful mechanical cleansing of the mouth should be insisted upon. Practical sterilization is brought about by the use of Miller's formula:

Saccharine.....	2
Benzoic acid.....	8
Tincture of rhatany.....	15
Alcohol.....	100
Oil of cinnamon.....	5
Oil of peppermint.....	5

A teaspoonful should be added to a quarter of a glass of water. Three successive portions should be held in the mouth for a minute each.

It should be remembered that the frequent use of strong antiseptics is harmful to the delicate lining membrane of the mouth, and more than offsets their usefulness as antiseptics. Tincture of rhatany, 15 parts, alcohol, 100 parts, makes a useful astringent. Indolent spots may be painted with a solution of nitrate of silver 6 gm. to 30 cc. The solution is better than the silver nitrate stick. Bleeding areas may be touched with a 95 per cent. solution of alcohol.

The hemorrhages are most annoying. Occasionally it may be necessary to let out the clots which form under the skin. On account of the liability to hemorrhage, the bowels should be moved with great care, and experience teaches that enemata are preferable to any but the mildest cathartics. Tannigen and tannalbin may prove of some little advantage in intestinal hemorrhages, but not much is to be expected from their use. The employment of rabbit's serum or horse's serum, to overcome the tendency to bleeding, occasionally proves to be of great help. Diph-

theritic serum might well serve in an emergency. The type of preparation and the amount depend upon the material available. It is quite possible that transfusion from a healthy donor would be of the greatest value.

OBESITY

The treatment of obesity is far more simple than we are often led to believe. Although this is true, prophylaxis is preferable, and the physician should be on the lookout for appropriate cases when a word in time will save future discomfort. It is a criterion of treatment to demand that during its course the strength of the patient improves and cheerfulness is maintained. Unsuccessful results are usually due to lack of knowledge on the part of the physician, or lack of obedience on the part of the patient.

Lüthje considers the collection of fat in the body pathological when it interferes in any manner with the bodily activities of the individual. To my mind this definition furnishes a far better sign of the disease than any arbitrary table of age, height, and weight. Such tables, however, are useful, and for this reason I insert the following:

Shepard's Table of Height and Weight¹

Height.			Age 15-24.		Age 25-29.		Age 30-39.		Age 40 and Over.	
Ft.	In.	Cm.	Lbs.	Kg.	Lbs.	Kg.	Lbs.	Kg.	Lbs.	Kg.
5	0	152.4	120	54.5	125	56.7	129	58.5	133	60.4
5	1	154.9	122	55.4	126	57.2	130	59.0	135	61.3
5	2	157.5	124	55.8	128	58.1	132	59.9	138	62.6
5	3	160.0	127	57.6	131	59.5	135	61.3	141	64.0
5	4	162.6	131	59.5	135	61.3	139	63.1	144	65.4
5	5	165.1	134	60.8	138	62.6	142	64.4	148	67.2
5	6	167.7	138	62.6	142	64.4	146	66.3	152	69.0
5	7	170.2	142	64.4	147	66.7	151	68.5	156	70.8
5	8	172.7	146	66.3	151	68.5	155	70.3	161	73.1
5	9	175.3	150	68.1	155	70.3	160	72.8	166	75.3
5	10	177.8	154	69.9	159	72.2	165	74.9	171	77.6
5	11	180.3	159	72.2	164	74.4	171	77.6	177	80.3
6	0	182.9	165	74.9	170	77.1	177	80.3	183	83.0
6	1	185.4	170	77.1	177	80.3	183	83.0	190	86.2
6	2	188.0	176	79.9	184	83.5	190	86.2	196	88.9
6	3	190.5	181	82.1	190	86.2	197	89.4	201	91.2

Etiology.—Obesity is due to too much food and too little exercise. As yet, constitutional obesity does not rest on a scientific basis. Deficient thyroid secretion may occasionally account for a case, but in ninety-nine cases out of one hundred the two causes first mentioned represent the true etiology.

Excess of Food.—The constancy of body weight for long periods is marvelous when the effect of a small daily addition to the diet is calculated for a period of years. A lump of sugar weighs 4 gm., and yields the equivalent of 16 calories of heat, but in a year nearly 6000 calories,

¹ Average for men and women with clothes. Clothes weigh 8-10 pounds.

enough to supply a healthy man at moderate work with food for two to three days. (See the Treatment of Diabetes, p. 440, for caloric values of foods.) A patient seldom feels he has overeaten if he takes an ounce of whisky daily, but in a year this quantity would furnish sufficient energy to maintain him at moderate work for twelve days. One ounce of whisky (30 gm.) contains 15 gm. alcohol $\times 7 = 105$ calories $\times 365 = 38,325$ calories. The effect of two tablespoonfuls of good cream would be nearly as great. Eating is much of a habit. Thus the patient may be accustomed to eat upon retiring, or to take fruit between meals, or to enjoy two portions of dessert, and in this way the secret of his obesity is explained. The habit of eating large quantities of food may have been contracted when the individual took more exercise. The duties of active life led to the curtailment of the time for exercise, but not for meals.

The individual may unconsciously have selected a diet rich in carbohydrate and low in protein. Upon such a diet the total number of calories consumed would be 3 per cent. less than upon a diet with much protein and little carbohydrate. This is due to the low specific dynamic action of carbohydrate and the high specific dynamic action of protein. In the course of months an excess of even 3 per cent. of energy would have a marked effect.

The total loss of body heat per kilo body weight is less in the obese individual because his body surface is proportionately smaller than in the thin subject. For this reason the same quantity of food per kilogram body weight may lead to a deposit of fat tissue in a fat individual, but furnish no more calories than would be necessary to maintain a spare subject in equilibrium.

Lack of Exercise.—Lack of exercise is fully as common a cause of obesity as increase in the food supply. The lack of exercise is often obvious, but frequently elusive. Two individuals may exercise and eat alike, yet one sleep an hour longer than the other. Instinctively, one individual chooses a reclining chair and another selects an upright chair. One is quiet, the other executes frequent movements even in the simplest conversation, and upon these characteristics depends the extent of the metabolism. Gain in weight usually takes place at that time of life when one is most apt to decrease the amount of exercise.

Physical deformities frequently lead to a reduction in exercise. At times these deformities are apparent, such as those due to rheumatism, but any disability, including obesity itself, which confines an individual to a bed, a chair, or restricts walking is usually attended by gain in weight. (See Table, p. 431, Treatment of Diabetes Mellitus.) Heart trouble and obesity are reciprocal in their action upon one another, and phthisis, strange to say, is now-a-days frequently associated with obesity, due to its treatment by food and rest. The influence of occupation is notorious, and a thin cook or a fat letter carrier is an anachronism.

Deficient Thyroid Secretion.—Excess of food and lack of exercise are external causes of obesity. From these sufficient and every-day explanations of the disease, patients, physicians, and even physiologists have often been lured away by the conception that there was some

internal cause of a mysterious nature. It was, therefore, a great satisfaction to all these classes of individuals when it was demonstrated scientifically that patients with deficient secretion of the thyroid gland showed a marked increase in weight, and that their metabolism was less than that of normal individuals. To-day deficient thyroid secretion constitutes the one and only definitely proved internal cause of obesity. The administration of the thyroid gland appeared to be such an easy remedy for obesity that it was enthusiastically adopted, but it soon proved to have its shady side.

Constitutional Obesity.—Rübner carefully studied the question by experiments in the respiration apparatus upon two brothers. Some of his results are recorded in the following table:

	Age, Years.	Weight, Kilograms.	Height, Centimeters.	Total calories in 24 hours.	Calories per kilogram.	Calories per square meter.
Thin Eugene..	11	26	135	1352	52	1290
Fat Otto.....	10	41	136	1786	44	1321

It is true that the calories per kilogram for fat Otto were lower than those for thin Eugene, but when one compares the total metabolism of the brothers for the twenty-four hours it will be seen that that of Otto was greater, and, what is more to the point, the metabolism per square meter of body surface was practically identical. Rübner's classic experiment furnished no support to the view that metabolism in fat people was decreased.

Some justification for this idea of lowered caloric needs in obesity is found in four experiments, two of them recently published by von Bergman. In these the subjects apparently lived upon rations approximately one-third less than the usual quantity. Should these experiments be confirmed, the question of constitutional obesity will be opened afresh. But in this connection I consider Luthje's observation pertinent, that one must bear in mind the relative ease with which one individual as compared with another performs a given act. Take carpentry, for instance, or, a homely example, carving at the dinner table.

Removal of the ovaries was supposed to cause a diminution in metabolism amounting to 12 per cent., but Luthje's experiments upon animals of both sexes tend to overthrow this hitherto accepted idea. It is certainly true that women at the menopause usually gain in weight, but this can be explained by diminished activity.

Treatment.—*Prophylaxis.*—Prophylaxis is fortunately favored by a strong incentive—pride—and this in a measure accounts for the diminution of obesity in the upper classes of society. Such patients treat themselves or present themselves for treatment of their own accord, but it is the task of the physician to detect the early stages of obesity in all his patients. If a physician acquires the habit of bearing this in mind he will almost instinctively pick out such individuals, and at this early stage diagnosis usually means cure. Susceptible individuals are those entering middle life, patients with chronic diseases or deformities, and patients with inactive occupations. The best treatment for these patients is prevention. The daily routine of life should be examined and its faults

demonstrated. The nutritive value of foods containing much fat or carbohydrate should be pointed out, the advantages of protein explained, and the small quantity of nourishment in most vegetables and fruits emphasized. Exercise should be insisted upon, and vacations of a type advocated which call this into play, for example, two weeks in the woods instead of two months in an automobile. The disadvantages of obesity should be plainly set forth, as well as the disfigurements—wrinkles and apparent increase in age—which result when obese patients lose much weight. There is no harm done in recalling to the patient's mind some conspicuous example.

Selection of Cases Suitable for Treatment.—Patients frequently ask to have their weight reduced when this is inadvisable.

As a rule, obesity is only a part of the diagnosis, so that the heart and bloodvessels, the kidneys, the digestive tract, and the nervous system should all be closely scrutinized. If treatment is undertaken, the whole aspect of the case will then receive suitable attention. Patients who have been fat for the greater part of their lives, elderly patients, children, and fat diabetics, bear restrictions of diet poorly, and if treated at all should undergo loss of weight very slowly and under the closest supervision.

General Considerations.—An explanation to the patient of the etiology of obesity and the methods of treatment is a prime necessity, so as to secure his intelligent coöperation. The details of treatment rest in his hands and he must appreciate their importance in order not to be distracted by the many lay suggestions offered. Confidence and obedience on the part of the patient are absolutely essential. Particularly should the patient be made to realize that just as the gain in weight was gradual, the loss of weight should be, and that the cure must extend over months and even years. Loss of fat takes place more uniformly throughout the body and abdominal fat is far more efficiently removed if the reduction of weight is gradual. With rapid loss of weight, strength is almost invariably sacrificed, and a cardinal principle of the treatment of obesity is broken. Rapid loss of weight is not becoming to the patient, for the elasticity of the skin is not sufficient under these conditions to prevent the appearance of folds and wrinkles. Finally, the patient is expected to live for years, and there is not the slightest justification for haste in treatment.

The weight of the patient should be taken upon rising, after the urine has been voided. Changes in weight of a few ounces are without significance. In the prophylactic treatment of obesity it is only necessary to have the patients weighed once a week, but in the active treatment of obesity the weight should be taken two or three times each week. By this means errors in diet can be detected and corrected at once.

The Diet.—The essential principle in the dietetic treatment of obesity is the reduction of the daily food supply. It is not the restriction of one or another group of food stuffs, but the restriction of the total quantity of food. Nevertheless, it is true that this restriction should apply almost exclusively to the carbohydrates, fats, and alcohol of the diet.

The protein should be retained in normal quantity, for it is essential

to life, is quickly oxidized, and increases the general metabolism of the body through its specific dynamic action. It is of interest that it is not necessary to increase the quantity of protein above the old Voit's standard of 120 gm., for experiments have shown that even though it is reduced to one-half this amount, along with a similar reduction of carbohydrates and fats, the patient will maintain nitrogenous equilibrium, living temporarily upon his fat, and not his muscular tissue. This rule applies only to patients with obesity. It is not applicable when treatment with thyroid extract is employed.

The quantity of fat in the diet of the obesity patient before treatment is begun is probably at least 100 gm. The exclusion of fat from the diet, therefore, permits a great reduction in its fuel value. Only once in my experience has the reduction of fat caused untoward symptoms. In this particular case the patient was greatly disturbed by hyperacidity of the stomach, a condition which theoretically might well arise under such circumstances, for the inhibitory influence of fat upon the secretion of the gastric juice is well known. There are several advantages in lowering the fat in the diet rather than other foods. Fat is taken in such forms that it is easily recognized by the patient, and the omission of butter, oil, cream, and the fat on meat presents no difficulties. Fat is a concentrated food, and its withdrawal lowers to only a very slight extent the bulk of the diet, which makes its loss felt less by the patient.

Carbohydrate foods are usually bulky foods, and their loss is felt more than the loss of fat. Carbohydrate has been considered to be a somewhat better sparer of body albumin than is fat, but this has not been demonstrated. These two considerations make the omission of fat rather than carbohydrate more rational. Particularly good foods for patients with obesity are vegetables containing considerable cellulose. Such are the vegetables usually employed in the treatment of diabetes, and to be found under the 5, 6, 10, and 15 per cent. carbohydrate groups of my list. (See p. 440.) The advantage of these vegetables is that they furnish bulk without nourishment, and they are easily eaten because their content in water is high. In case a salad dressing is desired for some of these green vegetables, it should be made with oil and lemon-juice or vinegar, rather than a mayonnaise dressing, because the latter adheres so much more to the vegetables.

Theoretically, alcohol is the best article to banish from the diet in the treatment of a case of obesity. It is universally recognized as unessential, it frequently exerts a harmful influence upon the body or the daily life of the individual, it is often a concentrated food, and so does not furnish that bulk which the patient with obesity has been accustomed to find in his diet; in moderate quantities it stimulates rather than depresses the appetite, and it is so readily oxidized that there is little chance of body fat being consumed when the alcohol is in the system. If it is at all employed, the quantity should be limited.

Restriction of water has no effect on metabolism, and it is a needless irritation to the patient to forbid it. At the beginning of treatment the restriction of water may lead to the patient eating less, but one soon

becomes accustomed to a small quantity of liquid in the diet. When the obesity is complicated by serious cardiac disease or edema the restriction of water is a great help.

The extreme restriction of sodium chloride in the diet at once causes a lowering of body weight. Goodall and I were able experimentally to decrease the weight of one subject 5.3 kilograms (12 pounds) in thirteen days, and of another subject 3.1 kilograms (7 pounds) in nine days by the omission of salt. The addition of 12 gm. of sodium chloride to the daily diet of the second subject for the three following days raised the weight 2.2 kilograms (5 pounds). There is no advantage in this restriction of salt in the diet of a case of obesity unless œdema is present. Such restriction may lower the weight, but actual body tissue is uninfluenced.

Exercise.—Exercise favors the retention of body protein, just as lack of exercise allows body protein to be gradually lost. For this reason exercise should invariably be employed in the treatment of obesity. It is not generally enough recognized that muscular work is done at the expense of fat and sugar, not protein. In other words, exercise favors the loss of the very tissues which it is most desirable to remove in the treatment of obesity.

Exercise should be prescribed along with the diet which has been indicated. The exercise should be progressive, never to a point of weariness, but enough to make a distinct impression upon the food supply. The exercise must be regular. The character of the exercise is indifferent, but it must be adapted to the needs of the individual case.

It is impracticable to measure the increase in exercise in heat equivalents, and I, therefore, rely on the time consumed or the work accomplished. Walking is the type of exercise most available. Roughly, an hour's walk at the rate of 3 to 4 miles an hour consumes 170 calories, in addition to the resting metabolism. The use of a pedometer interests and stimulates the patient to maintain or increase the length of his walks. Other forms of exercise may be employed, but their effect in each individual case must be studied.

Treatment of the Individual Case.—The special etiology of each individual case should be investigated. A cause for the obesity may be found by a study of the habits, either dietetic or physical, and the correction of some habit may be all the treatment that is required. Success and ease in treatment depend to a large extent upon discovering the cause, and it is well worth while to devote much time to such an investigation. Bearing in mind the principles above enunciated, the advice to the patient follows:

The first week of treatment. This may constitute a preliminary period. The patient is advised to avoid obviously fatty foods, such as cream, butter, oil, and fat meat, and to omit or substitute saccharin for sugar. If at the end of three or four days the weight has fallen half a kilogram (1 pound), one may well be satisfied. A loss of 1 pound a week during a period of four months is a rapid enough loss of weight, and far safer than to have the 16 pounds lost in one month or even two

months. A determination of the urinary nitrogen or a rough calculation of the nitrogen in the food will show whether sufficient protein is being ingested; 90 gm. of protein (14 gm. urinary nitrogen) constitute a safe amount, and variations from this figure should tend upward rather than downward.

The second week. Should the weight of the patient not have fallen by the expiration of one week, further restrictions in diet are necessary. It will usually be found sufficient under these circumstances to prescribe the diet of the first week, and in addition to limit the quantity of bread at a meal to 30 gm. (one small slice), and to prohibit the use of any food to which sugar has been added in the preparation. Milk and foods with milk in them must be forbidden, and only one tablespoonful of a cereal, or in lieu of it, an equal quantity of potato, rice, macaroni, or dessert allowed at a meal.

The third week. It is a rare case which does not show a steady falling off in weight under the conditions prescribed above, but it is always a good plan at the second visit of the patient to request that a list be kept of all foods eaten, so that errors in diet can be promptly corrected in case the weight does not fall. If this proves to be the case, the use of bread must be made as an alternate to the tablespoonful of farinaceous foods, just enumerated. Aside from the restriction of bread, and the exposure of dietetic errors, there is usually little further change to be made. The detection of such errors is all important.

Whenever the diet is restricted in quantity the number of meals of the patient should be increased. Suitable articles for such lunches are an orange or an apple (not banana), the white of an egg with orange- or lemon-juice, buttermilk, and skimmed milk. Bouillon is apt to be too stimulating to the appetite. As a rule, food should be given in the forenoon, afternoon, and upon retiring.

It will be unnecessary to repeat what has already been said upon the importance of exercise and its adaptation to the individual patient.

A faithful carrying out of the suggestions given under diet and exercise has seldom, if ever, failed to bring about the desired loss of weight in my patients. Possibly I am contented with too moderate losses, but I know it is safer to err in this direction. It is my belief that a loss of 15 pounds in the first four to six months is quite enough. During the next six months 5 or, rarely, 10 pounds may be sacrificed, and this is a sufficiently rapid rate for the second twelve months.

It is the custom of the books to prescribe a definite number of calories by which the diet is to be restricted during the course of treatment. Thus, the first phase of treatment calls for a restriction of one-fifth of the total number of calories required for normal maintenance, the next phase of treatment a restriction of two-fifths, and finally, of a three-fifths reduction in the total calories. Such a method does not appeal to me because it does not allow enough latitude to the patient to accommodate his diet to the varying demands of daily life. It does not seem to me wise to employ a restriction of three-fifths of the diet under any circumstances, and I should regret to limit the diet by even two-fifths of the

original quantity, except upon rare occasions. We may rest assured that a diminution of the maintenance diet by one-fifth will in the end cause a reduction of the weight, and if this reduction is gradual so much the better. It is seldom possible to accurately control the caloric value of the diet of the patient when he is at home, and I do not think it often advisable to remove a patient to a hospital for the installation of treatment. The treatment of obesity is too prolonged for such a purpose, and it is preferable that the patient learn to accommodate his daily life to the exigencies of the treatment.

If for any reason it is desirable to watch more closely the caloric value of the diet, the requirements of the patient can be determined by taking the lower of the figures given on p. 439 for the caloric needs of the body under the various conditions of rest—slight, moderate, and severe work. Thus, if we allow 35 to 40 calories per kilo body weight for the normal individual at moderate work, we would allow 35 calories to the patient with obesity. Another method which has been proposed bases the caloric needs of the obese patient on the ideal weight of an individual of similar age and height.

If the individual is over forty years of age, 5 feet 10 inches tall, and weighs 100 kilos (220 pounds), the diet which is necessary to maintain body weight at moderate work should contain (100×35) 3500 calories; or, calculated by the second method above cited (77.7×40) , 3108 calories. The inaccuracy of the methods is shown by the discrepancy between the results of the calculated maintenance diet. If the maintenance diet lies between 3100 and 3600 calories, it will be necessary to reduce this to between 2500 and 3000 calories to effect a loss of fat tissue.

It is easy to arrange such a diet with the use of the diet chart on p. 440. Care should be taken to provide 90 to 125 gm. protein (equivalent to 13–18 gm. of urinary nitrogen) in the ingested food.

Food.	Quantity. Gm.	Protein. Gm.	Carbohydrate. Gm.	Fat. Gm.	Calories.
Meat, uncooked	360	75	...	18	460
Egg	2	12	...	10	150
Milk, skimmed	150	6	8	..	55
Potato	200	4	40	..	180
Vegetables	450	9	50	..	240
Fruit	300				
Bread	400	38	220	..	1000
Butter	30	...	...	25	225
		144	318	53	2310

von Noorden suggests that a diet will represent approximately a lowering of one-fifth of the ordinary diet if all visible fats (butter, oil, meat fats, etc.) are omitted, and vegetables and dishes made from flour are prepared with little fat, and the use of beer and wine is restricted. A lowering of about two-fifths of the normal diet will be accomplished if dishes made from flour, stewed fruits, milk, and soups containing flour are excluded as well. von Noorden also gives the following diet as corresponding to a lowering of three-fifths of the normal diet of a patient whose ideal weight is 70 kilograms.

Coffee, tea without additions.

Meat broth (fat skimmed off) with vegetables.

Lean meat or fish (total weight 250 to 350 gm., weighed cooked).

Lean cheese.

Abundant green vegetables and salads prepared with as little fat or oil as possible.

Vinegar, lemon, vinegar pickles, brine pickles, tomatoes, celery, and radishes.

Abundant raw fruit, with a small percentage of sugar (apples, peaches, strawberries, raspberries, currants, blueberries, sour cherries, grape-fruit, early oranges, etc.).

Coarse bread (bran bread, Graham bread) in quantities of from 40 to 70 gm.

Potatoes (prepared without fat) in quantities of from 80 to 150 gm.

Mineral waters ad libitum.

Wine, in weak persons, up to 200 gm., preferably omitted altogether.

One to two eggs.

Skimmed milk.

Buttermilk.

The Use of Milk.—The use of milk was advocated many years ago by Carrell, and has lately been brought into prominence by Moritz. Milk is a diuretic and satisfying, even though given in quantities of only 200 cc. five to eight times in the day. Moritz determines the standard weight in kilograms of the individual for his age and height, and for each kilogram of this standard weight he allows 16 to 17 calories. This is represented by giving 25 cc. of milk for each kilogram of weight five times daily. The disadvantages of the milk diet are that it is a temporary expedient, and when the cure is over the patient must begin to learn how to live on his customary food and yet not gain weight. The diet presents too radical a change for the treatment of a condition which does not demand radical measures.

Thyroid Medication.—It is seldom that a patient comes to the physician who should be treated with thyroid medication. Such an individual is usually detected only after considerable observation. It is taken for granted that myxedema is absent. A patient of this type may be suspected if, after following the rules of diet given above, no loss in weight ensues, and the actions of the patient suggest from their analogy to myxedema that thyroid secretion is deficient. The use of thyroid extract in such a patient is justifiable, but it must be remembered that the employment of the thyroid gland not only reduces the weight, but increases the metabolism of body protein. Consequently, the diet of such a patient should be unusually rich in protein. It is safe, too, never to allow the weight, under these circumstances, to fall more rapidly than 1 pound a week.

Various preparations of the thyroid gland are upon the market. That preparation should be selected which is known to have been used with effect in the treatment of myxedema, or which can be considered reliable because of the character of the firm manufacturing it. Not over 0.3 gm. (5 grains) of the extract should be given daily, and preferably less at the start. Under no circumstances should the medication continue for over four to five weeks at a time. After an interval of a month or more it may be resumed. The urine should be tested at frequent intervals during its employment, because of the known possibility of the appearance of glycosuria.

Mineral Waters.—Mineral waters are frequently employed by the laity in the treatment of obesity. Their effect is extremely slight, and considered to be due to the removal of undigested food from the body, but the amount of material so removed is far less than supposed. Their use is not to be encouraged with the idea that they have any specific value.

Baths.—The employment of hot or electric light baths followed by cold douches in the treatment of obesity is helpful, not because of any marked specific action upon the metabolism, but because they are invigorating and at the same time restful. Cold baths also toughen the body and render the patient less liable to colds. This is a factor worthy of consideration, for obese patients perspire so easily that they are susceptible to draughts. Baths also are most efficacious in cooling off the body, and this is often of distinct value. The amount of heat lost by a cold bath is very considerable. When exercise—swimming—is undertaken in cold water the loss of heat is greatly augmented.

DISEASES OF THE THYROID AND THYMUS GLANDS

By S. P. BEEBE, M.D.

FOR the purposes of this chapter the pathological conditions of the thyroid which demand treatment will be classified as follows:

1. Inflammations.
2. Goitre, including exophthalmic goitre.
3. Malignant tumors.

The thyroid gland is as subject to acute inflammation as other tissues are, and in most respects the indications for treatment are similar to those followed in treating an acute inflammatory process in the lymph-glands of the neck. In most instances the acute inflammation is the accompaniment or sequel of some acute infection, such as acute rheumatism, infections in the tonsils, influenza, measles, dysentery, cholera, malaria, scarlet fever, smallpox, typhoid, or puerperal fever. Very rarely, indeed, does there occur an acute inflammation in the thyroid which cannot be related to some accompanying or prior infection. The cardinal symptoms of pain, heat, and swelling are noted, and generally there will be marked difficulty in swallowing, with loss of voice. Palpation shows extreme tenderness in the gland, and in most cases there is a uniform enlargement with the outlines generally not sharply defined because of the surrounding edema. In Graves' disease there is occasionally a very rapid increase in size of the gland, which may be more than usually tender, and occasionally the typical acute inflammation of the gland is accompanied by mild symptoms of Graves' disease. The diagnosis is, therefore, at times difficult; especially as a typical development of Graves' disease often dates from a preceding infection, and may be accompanied by a typical, though generally mild, thyroiditis. In some cases thyroiditis may be treated with apparent success and the symptoms of Graves' disease develop shortly afterward.

Some points of differentiation may be of value, and the following table is offered for this purpose, the differential points being contrasted in two columns:

Acute infectious thyroiditis, accompanied by mild symptoms of Graves' disease.

1. Both conditions may follow infections, the acute thyroiditis more closely and directly.
2. Either one or both lobes symmetrically enlarged, slightly edematous and *exquisitely tender*, with pain radiating to the occipital region, to the ears, sometimes to the teeth, or shoulders.
3. Temperature 99.5° to 104° F.
4. Symptoms of Graves' disease are mild and in no way correspond with the severity of other features of the condition.
5. Blood-count that of infection, with marked polycythemia.

Acute Graves' disease, accompanied by a mild thyroiditis.

- 1.
2. Enlargement may effect one or both lobes, generally both, tenderness, induration, and edema not nearly so marked, and not painful except on palpation.
3. Temperature generally lower, though it may occasionally be as high as 104° F.
4. Heart rapid, irregular, dilated, with loud systolic murmur heard over apex, base, and in vessels of neck. Vomiting, extreme nervousness, sweating, delirium, insomnia.
5. Blood-count shows little increase in white count, with a relative lymphocytosis.

The treatment of these two conditions is decidedly different, and the differentiation is, therefore, of decided importance.

A patient with acute thyroiditis should be put to bed, the bowels kept open with a saline cathartic, the diet confined to milk, eggs, and cereals. For the treatment of the local condition the ice-bag should be applied to the neck continuously, care being taken that only a small quantity of ice is put in the bag at a time, so that its weight will not add to the patient's difficulties. I prefer to alternate the application of the ice-bag with the use of hot flaxseed poultices, allowing ice applications for one hour, hot poultices for one hour, and then one hour's rest, following this programme three to four times in the twenty-four hours. Such a programme is followed, however, only in infectious thyroiditis. In other cases the continuous ice-bag is best.

The deeper lymphatic glands are nearly always involved to some extent, and there should be frequent examinations of the pharynx to determine the extent of the swelling and the possible danger from edema.

The acute phases of the inflammation do not persist long, as a rule, not more than three to five days, and the whole process rarely is troublesome for more than two to three weeks. With the subsidence of the acute inflammation the swelling may reduce to a point where the gland may no longer be palpable.

Occasionally the process is so severe that the gland breaks down and suppurates, and it may perforate externally into the œsophagus or burrow downward into the trachea. As soon as suppuration is detected a surgical incision must be made through the capsule, preferably low down on the neck, and thorough drainage insured for a few days. *There should be no delay in opening the gland as soon as suppuration is detected.* When an abscess is suspected, the gland should be explored with a small needle, under rigid asepsis; the diagnosis may thus be established and a culture obtained for vaccine therapy. The use of a trocar, either for

the purpose of obtaining tissue for diagnosis or for surgical drainage, should not be permitted.

There are a few cases on record in which an acute suppurative inflammation of the thyroid is followed by symptoms of myxedema, but in none of these cases, so far as I am aware, has there been an accompanying tetany. The thyroid is to be regarded as a vital organ, and for this reason as well suppurative inflammation demands instant attention.

GOITRE

There is probably no more difficult chapter in pathology than that which concerns the thyroid gland. We have not yet a satisfactory classification of the changes which take place in thyroid disease. It is especially difficult to say where cellular hyperplasia ends and a malignant process begins; and recent observations regarding this matter have made it seem that a different basis for classification must be followed in dealing with the thyroid than obtains with other epithelial tissues.

The clinical distinctions between various types of thyroid disorder are quite as uncertain as the pathological classification. With such an uncertain basis therapeutics can scarcely be other than empirical. Certain well-authenticated observations have been made, however. We know that simple enlargement of the thyroid gland without symptoms may be sporadic, endemic, or epidemic in character. We know that the enlargement may be of an acute character, subsiding in a few days or weeks without treatment, or it may have a chronic character and persist for years. In respect to its histological character, it may be simply an enlarged gland, the mutual relations of the various elements being normal; there may be hyperplasia of the glandular elements (parenchymatous goitre) or of the stroma (fibrous goitre), or both may be affected. There may be very marked enlargement of the alveoli, which are filled with colloid, colloid goitre; occasionally single or multiple cysts filled with hemorrhagic colloid are found. In some instances the gland seems to depend for its size chiefly upon a much-increased supply of blood, vascular goitre. (It must be understood that this classification is simply for the purpose of this chapter).

There can scarcely be any doubt that a variety of factors produce an enlargement of the thyroid. During recent years there has been an increasing amount of evidence that endemic goitre, which in certain regions affects all the mammals, sheep, pigs, dogs, cows, horses, and the human subject has its origin either in some living microörganism or some unstable chemical substance. In certain regions in Michigan, Colorado, Wisconsin, Ontario, New York, Montana, and California a large percentage of animals have grossly enlarged glands, while a normal gland from the histological standpoint can scarcely be found. At times epidemics of goitre resembling in character and extent an epidemic of typhoid have been noted. Clinical observations have for many years pointed to water as the source of infection. Certain wells have been found in Switzerland, India, various parts of Europe, as well as this

country, whose water almost invariably causes goitre, the swelling appearing in a few days, and progressively increasing to gross tumors. Filtration of the water through a Berkefeld Bougie does not prevent its action, but heating to 80° F. for one-half hour or boiling renders it inert.

From the prophylactic standpoint there can be no doubt of the advisability of people living in known goitrous regions boiling the water used for drinking purposes, as well as that used for washing fresh vegetables, such as lettuce, radishes, celery, etc., which are eaten raw.

The evidence in favor of some forms of goitre being caused by a water-borne infection is so definite that so simple a measure as the use of boiled water should be in no instance neglected. It must be understood that this statement applies as a prophylactic measure, and as a means of therapeutics in those cases treated during the developing period. Cystic, fibrous, and malignant goitres can scarcely be expected to yield to this measure.

For a long period it has been known that iodine has a very favorable effect in reducing some types of thyroid enlargements. Since our discovery of the very important role which iodine has in thyroid physiology, we have an approach to a rational basis for its use. As a result of the experimental work of recent years we can formulate certain principles respecting the iodine relations to the thyroid:

1. Iodine is a constituent of all thyroid glands.
2. The physiological action of thyroid extract depends upon a highly complex iodized proteid, and its physiologic value seems to be directly in proportion to the iodine so combined.
3. The normal gland contains an average of between .30 to .38 mgm. of iodine to a gram of fresh gland, but there may be histologically normal glands with iodine values much above or below this number.
4. In general, goiters either of the parenchymatous or colloid type contain relatively less iodine than a normal gland. The glands of these types absorb iodine readily and its use is often accompanied by marked decrease in the gross size of the gland.
5. The thyroid will store iodine from almost any iodine-containing substance which may be administered.

A great variety of methods of administering iodine have been in vogue, such as the following:

1. Potassium iodide, given locally over the gland by cataphoresis.
2. Inunction of ointment of the red iodide of mercury.
3. Inunction of various iodized fats, which have recently been put on the market.
4. Administration by stomach of a variety of iodine compounds, the most commonly used of which are ferrous iodide, potassium iodide, and hydriodic acid.

The glands most favorable for iodine therapy are the cellular hyperplasias and the early colloid type. The earlier in the stage of enlargement iodine administration is begun the more favorable is the prognosis. Old colloids and fibrous and cystic glands will not be favorably influenced by iodine.

It has been known for a long time that iodine occasionally caused marked symptoms of iodism when given in small doses to patients suffering from goitre. If there is a marked cellular hyperplasia, it seems probable that these cells have a functional possibility of making a much larger quantity of functionally active proteid, providing there is an adequate iodine supply, and we know that glands in animals that are very poor in iodine absorb it by a most remarkable selective action and store considerable quantities of it, so that a secretion poor in iodine may by such treatment rapidly become rich in iodine and, for that reason, much more active. It should be a rule in beginning a treatment of goitre with iodine that small doses should be used. If this rule is not followed, no serious harm will result in a large majority of cases. Such a practitioner is sooner or later certain to cause a very acute hyperthyroidism in some goitre patient with, perhaps, disastrous results. During the last year I have seen two patients who were given iodine as a routine measure in the treatment of specific disease. The fact was overlooked that they had a goitre. Very soon the development of a severe acute hyperthyroidism drew their attention to a matter which they had previously overlooked; it does not need a large quantity of iodine to get all the favorable results which iodine therapy can accomplish. It should, however, be continued in small dosage over a considerable period of time. By small dosage I mean that in the beginning not more than 15 gr. of potassium iodide should be given in twenty-four hours, and the dosage should be kept at this rate for a week or ten days before any increase is made, and the increase should be a gradual one. The patient should be frequently under the physician's observation, and in no case is it necessary to go higher than 5 gr. three times a day to get the best results. In the majority of cases a smaller dosage than this—1 to 3 gr. three times a day—will give all the beneficial effects that may be accomplished by iodine. This dosage should be continued for from six to ten months. The other methods of administering iodine have their partisans, but, in my opinion, the therapeutic effect is but little better than the administration of potassium iodide by mouth. The administration of red iodide of mercury ointment may possibly accomplish a reduction in the size of the gland somewhat earlier than the other forms, and, if used carefully, there is no danger to be apprehended. Only a small amount should be used each day, but this amount should be sufficient to keep the skin over the gland in a somewhat irritated condition.

The x-rays have been used a great deal in recent years to cause a reduction in the size of a goitre, and in skilful hands 58 to 75 per cent. of the cases may show marked reduction. In some instances this is so marked that a practically normal condition is reproduced, but quite a large percentage of these cases recur when treatment is stopped. There is no question that glands in the state of cellular hyperplasia very often respond in quite remarkable fashion to the administration of thyroid extract. This, too, when administration of iodine in other forms has been without avail. The thyroid extract should be administered in small quantities in the beginning and gradually increased.

The administration of thyroid to a patient with goitre should be under the same precautions as the administration of iodine. The tension in the gland and pressure symptoms, which are occasionally very annoying, may be relieved very promptly by administration of thyroid. This is especially true in the extremely cellular glands, which are often very hard and which may be at times diagnosed as malignant in character.

To summarize, then, a goitre developing in a young woman from fourteen to twenty years of age should be treated as soon as it is discovered. If the patient is exhausted or in a run-down, tired-out condition, rest is obviously necessary. A change of climate, with its accompanying change in water supply, may be advisable. The administration of iodine in some form should be begun. I prefer, personally, to begin with the iodide of iron, which should be continued over at least two months. If there is not some change observed in four to eight weeks of this treatment, it will be advisable to add to it a small quantity of thyroid proteid. A very large percentage of simple goitres which are observed in the early stages will yield more or less readily to this simple treatment. If it does not avail, other forms of iodine mentioned above should be tried, and *x*-rays might be considered as the last agency to be employed. If these measures still do not reduce the size of the gland, and if there are no symptoms of hyperthyroidism accompanying it, the condition probably is a harmless one in most respects, and yet such an individual needs to be examined not infrequently by a physician, to see that a change in the behavior of the gland and its physiological effects has not taken place. After a sufficient period of medical treatment has demonstrated its ineffectiveness, a surgical operation may be advisable.

HYPERTHYROIDISM

Under this term will be considered the conditions which have been associated with various names, such as Graves' disease, Basedow's disease, Parry's disease, exophthalmic goitre, toxic goitre. This condition, as we understand it to-day, is one in which the symptoms primarily are caused by the absorption of too large a quantity of material from the thyroid gland, so that the thyroid gland is, in typical cases, the most important tissue from a pathological standpoint. However, the pathology of Graves' disease does not end here. Such cases as have had the condition in such a severe form as to come to autopsy have shown a very marked involvement in other tissues, such as the thymus gland and lymphatic tissue. The adrenal, the hypophysis, the pancreas, and the pituitary may be the seat of a marked pathological change which appears to bear some relation to the character of the disorder. The therapeutic problem, therefore, in Graves' disease is one of the most complex with which we have to deal. While the typical symptoms may, in a large part, be duplicated by artificial administration of thyroid gland to normal animals, such experiments have not actually duplicated the conditions which arise in nature.

The main point in the therapeutic problem is to diminish the quan-

tity of thyroid secretion, or to combat its toxic effect after it has reached the circulation, and to restore the functional activity of the gland to physiological limits. In addition to this point, we must consider that in a large percentage of the cases which come for treatment secondary changes have taken place as a result of the continued toxemia; such, for instance, as severe myocardial changes; the skeletal muscles also are weak and flabby, the nutrition is disordered, the nervous system is profoundly affected, and the patient mentally depressed, hysterical, or abnormally excitable, at times quite approaching a manic condition. If, by some means, such as surgical operation, the excess of secretion should be stopped instantly, it would yet require some weeks or months before a normal state of affairs would be again established and the damaged tissues approximate normal conditions. Another factor which complicates the therapeutic problem is the fact that scarcely more than 50 per cent. of the cases present a pure type of hyperthyroidism, or, if pure in the beginning, other ductless glands have been swept into the field of action by the same cause which has started the hyperthyroidism, or they have reacted by increased function for the purpose of protecting the organism. The work of the last few years has brought forth additional proof that the ductless glands have close functional interrelationships which are in part controlled by the sympathetic nervous system, and probably, in large part, by means of hormones or chemical messengers. Graves' disease is an example of what may occur when these normal harmonious relations become discordant.

It is not the purpose of this article to go into a description of the clinical conditions and medical phases of the disturbance as this would, in itself, involve more space than is available.

For the purposes of treatment, we may classify the different types ordinarily seen as follows:

Classification of Clinical Types of Graves' Disease.—1. Typical exophthalmic goitre in the early stages, including the incipient, the mild, the severe, and those extremely severe forms which develop very rapidly and have been described as the acute toxemic type, resembling malignant endocarditis.

2. Typical exophthalmic goitre in cases which may have existed for some time in subacute form with occasional exacerbations, but without marked secondary changes.

3. (a) Patients who develop thyroidism after reaching the age of forty or fifty years.

(b) Those who, after middle life, show thyroidism for a varying period before the appearance of a goitre.

(c) Those who have borne an innocuous goitre for years and late in life develop signs of thyroidism.

4. *Atypical Forms of Thyroidism.*—(a) Men and, more often, women of any age who present many signs of thyroidism, but who often have a dry skin and bradycardia, and are usually considered neurotic or neurasthenic.

(b) Patients with nervous and vasomotor signs of thyroidism, but

who complain of a more or less constant headache, accompanied in most cases by nausea and abdominal discomfort.

(c) The psychopathic cases, the mental disturbance having no definite relation to the severity or type of thyroidism.

There is no disease in which the management of the patient with respect to activity, diet, sleep, and general hygienic control are so important as in Graves' disease. These factors will be discussed first.

Rest.—There is no other single factor of so much importance as rest, both physical and mental. With many of the very mild or incipient cases no further treatment may be needed than simply to put the patient to bed for some weeks, away from all anxious friends and relatives. It is quite common to find young women from sixteen to twenty-two years who, as a result of physical and mental overwork in high-school or college, have slightly enlarged thyroids, mild tachycardia, and tremor, with sleeplessness and physical weakness. In many instances a week's rest results in complete relief from these symptoms. With the more severe forms, rest becomes a much more necessary accompaniment of any form of treatment. The patient's activities must be controlled before any treatment can be successful; the more marked the symptoms the more necessary it is to secure complete rest. Dispensary patients and those whose financial condition requires them to work, cannot be treated with the same hope of success as those who are in complete control of the physician. This point needs especial emphasis, for I have occasionally seen instances where the patient has been advised that active out-of-door exercise would be good for the nerves. It is not to be understood that the patient need be confined to bed continuously, but it is always best to begin treatment by insisting on as complete rest as the circumstances will permit.

Sleep.—Many hours of sleep are advisable even after the patient has recovered a fairly normal condition, and for some months after active treatment has stopped the patient should not allow social activities to interfere with sleep.

Exercise.—What has been said in regard to rest explains in part the position to take in regard to exercise. During the acute stage the patient must be absolutely quiet, and when activity is resumed it must be a carefully graduated process. The muscles are peculiarly weak during and after hyperthyroidism. Müller has made some direct measurements which show this point, while Schaffer's analyses show ideas in regard to the correlation between muscular inefficiency and low kreatinin excretion which are strikingly confirmed. Cardiac muscle shares in the general muscular weakness, and on this account too speedy a resumption of activity may be fraught with danger. It is probable that in Graves' patient a larger proportion of the energy of the tissue metabolism in the muscles is expressed as heat and a smaller proportion as external work than is normally the case. In many cases I have seen threatened and occasionally *actual* cardiac incompetence follow injudicious exercise at a time when all active signs of the disease had passed

and the heart had resumed a normal rate and force. The notion that the heart suffers only functional disturbance in hyperthyroidism is pernicious and dangerous if it leads to advising the patient that he is well the moment the active stage has been passed.

Diet.—Regarding the feeding of the patient there is some difference of opinion. In the majority of cases there is a history of loss of weight which may be more or less severe, at times amounting to 40 per cent. of the normal weight of the patient. This loss in the acute periods is partly due to the gastro-intestinal disturbance, the vomiting, and diarrhœa. But even with the appetite and digestion in apparently perfect physiological condition there is loss of weight due to the increased oxidation of body tissue. Both factors are to be explained by the hyperthyroidism, and no single article of food or system of dieting is responsible for or will repair the deranged condition. The hyperthyroidism must be controlled before the nutritive conditions can be normal.

A plain, simple diet of well-cooked foods, not entirely excluding meat, should be furnished the patient in abundance. If he is losing weight while digestion is normal, it may be possible to stop the loss by increasing the calorific value of the diet, but it often is not possible to do so. The calorific needs of the Graves' patient in the active stages of the disorder are considerably more than those of a normal person. There is great increase in the consumption of oxygen (50 to 70 per cent.) in some cases, an increase in part due to the increased heart action, the marked jactitation, and muscular tremors, but which cannot all be accounted for in this way, and is probably due to the factor of hyperthyroidism. The fact that during the toxic acute periods there is a large nitrogen loss should not lead to the conclusion that a high nitrogen diet is especially desirable. It is much safer and more effective to get the increased calories from carbohydrates and fats. Stimulants, such as tea, coffee, and alcohol, should be absolutely prohibited. When the acute stage has passed, the question of diet rarely causes the patient or physician any trouble.

Bathing.—The skin should be kept in good condition, which requires frequent bathing. Frequent changes of clothing are necessary because of the excessive perspiration. Aside from the question of cleanliness, some tonic effect may be expected from simple sponging with cool water. The patient is readily exhausted and any procedure which excites the heart is not to be allowed. The shock of a cold tub bath to a patient unaccustomed to it may be serious in its consequences. Hot weather, with a high relative humidity, is an especially trying time. The efforts of nature to dissipate heat by evaporation of an abundant cutaneous secretion are nullified by the atmospheric conditions. Frequent cool sponging, with some means for providing a reasonable current of air, is agreeable and helpful. If the patient begins gradually, a cool shower-bath may be taken in the morning, followed by a brisk rub down, but such a method should be begun carefully, with water just below body temperature for the beginning baths, and then gradually lowered as the habit is formed.

Social Activity and Mental Excitement.—In no disease is it more necessary to secure suitable surroundings, both physical and mental. The patient must be kept quiet and protected from the pernicious influence of gossiping relatives and friends. In many cases this is a very difficult matter to manage, for the patient may be greatly stimulated by the hyperthyroidism and be quite unreasonable to control. In this relation a skilful nurse is of the greatest value. Depressing or startling news must be kept from the patient. During the acute stage practically no visitors should be allowed.

The primary considerations to be kept in mind are that the Graves' patient is, in most cases, very impressionable, and may be seriously disturbed by incidents which scarcely effect a normal person. In about 40 per cent. of cases in which I have been interested there is a definite history of some nervous shock which apparently ushered in the active symptoms of the disorder. As examples of these I mention the following: First, A family quarrel, in which the father threatens suicide, rushes from the house, and plunges into a nearby river. Second, Patient is knocked down by a car in a crowded street and severely frightened, but not injured. Third, Sudden death of near relative in presence of patient. Fourth, Patient, being unable to swim, is capsized in a row boat on a small lake and is rescued at once without injury. Fifth, Explosion of a large firecracker under chair of patient with no physical injury. Sixth, Mental strain of an exacting examination. The recital of these incidents could be continued for pages. Very often it is probable that some indications of the condition might have been discovered by careful examination previous to the incident, but there are other cases when it seems impossible. In many cases a smooth and satisfactory convalescence is interrupted and a serious exacerbation caused by some violent emotional disturbance. Regular hours of sleep, with freedom from petty cares and mental excitement, are most necessary for some months during convalescence.

I have seen patients who were making fine progress toward complete recovery suffer severely from such injudicious experiences as a visit to Coney Island, a series of religious revivals, the visit of a neurasthenic relative, etc. We do not know the precise mechanism of this reaction, but it seems probable that it is accomplished through a vasomotor disturbance, by which the volume of blood circulating through the gland is increased and more of the thyroid secretion absorbed.

A considerable percentage of these patients are at times very easily excited sexually. The gratification of this impulse is generally a serious matter, and may cause a severe exacerbation of the condition. One of my patients violated instructions in this respect and suffered an immediate, acute relapse which proved fatal.

The physician must insist that a regular, simple life, without exception, must be the habit for several months after the patient is able to be out. When the patient feels well it is difficult to secure adherence to such a plan, and relapses and exacerbations of varying degrees of severity will follow.

Climate.—Graves' patients are most comfortable during the colder months of the year. Hot weather, particularly with a high relative humidity, is a very trying time for them, and there are many relapses and exacerbations during such periods. A location about 1500 to 2000 feet above the sea-level, with abundant sunshine, moderate winds, dry air, and freedom from fog are the conditions which make the patient most comfortable. The Adirondacks and White Mountains afford many suitable places for spending the hot months.

Infections of the Tonsils.—Forty to 50 per cent. of patients developing Graves' disease have a very definite history of some severe mental shock or emotional disturbance immediately preceding the development of the disease, but a careful examination of these instances will show, in many cases, that the emotional disturbance has been only a match to set off an explosion which had been prepared by some previous physical disturbance.

The infection of the tonsil plays a very important part in the development of goitre. Before symptoms have been noted and during the course of the disease repeated tonsillar infections are not uncommon, and they invariably cause a severe exacerbation of symptoms. The development of goitre in a large percentage of cases will be coincident with some particular attack of acute tonsillitis, and although the characteristic symptoms of the disease may not develop at once, following increase in the size of the gland, yet they have a very definite relation to this event. It is most important, then, that the conditions of the tonsils should be carefully inquired into and every precaution possible taken to prevent their repeated infection. When the condition of the patient warrants it the tonsils should be carefully and completely dissected out. When it is not possible, it should be remembered that an acute tonsillitis is one of the most serious intercurrent disturbances which these patients have, and every possible precaution should be taken to prevent its recurrence.

A very large number of different therapeutic agents have been used in the treatment of Graves' disease. It is inevitable in any disease in which there is not an inconsiderable percentage of individuals who will recover spontaneously regardless of the form of treatment. I shall consider only the most important of the medical measures which are used and their specific effects upon the disease. These are the hydrobromate of quinine in conjunction with ergot, various preparations of the serum or milk of animals from whom the thyroid gland has been removed, the thyroid preparations, the x-rays, and the specific cytotoxic serum prepared by inoculating proteid from the human thyroid into alien animals.

Hyperthyroidism is a serious condition and one which deserves most careful treatment. The undoubted fact that a small percentage of those affected with it recover by rest and simple tonic treatment is not to be accepted as an excuse for using no other medical measures. It is a serious condition, and in the last 250 cases which I have treated there have been 9 deaths, and there is no question that these individuals are more susceptible to intercurrent infections and to other constitutional

disturbances, so that their period of expectation of life is decidedly shortened.

The treatment with hydrobromate of quinine combined with ergot has been very strongly recommended by Forchheimer, and, following his recommendation, has had fairly wide use in this country. The dosage should be 5 gr. of the hydrobromate three times a day. If, after three or four days, there is not definite improvement, there should be combined with this 1 gr. of ergot. It may be necessary to continue treatment for a long period of time (two or three years). Very definite improvement should be expected within the first week, but a final readjustment of the gland to a stable condition may not follow for a long time. The treatment used by Forchheimer has been very successful in his hands. Others who have used it report varying results. I am, personally, unable to report on a large series of cases. It seems probable that the reason most men have not been able to duplicate Forchheimer's good results with the method is due to the fact that they do not use it as intelligently as he does, and the cases were not properly selected. The information at my disposal in regard to this method is almost entirely based upon observation of patients to whom this treatment has been given for a considerable period of time, and from these observations I conclude that 40 to 50 per cent. of the cases on which it is tried show some benefit. It appears, therefore, to control symptoms to some extent without attacking the basis of the disorder. The method is a simple one, and may well form an addition to the usual rest and tonic treatment.

Since the publication of Möbius' ideas in regard to Graves' disease there have been put upon the market for therapeutic purposes a number of different preparations prepared from the serum or milk from thyroidectomized animals. These have had various names, such as antithyroidin, thyroidectine, rodagen. It was Möbius' belief that the serum and milk of thyroidectomized animals contained substances which had accumulated there because of the lack of thyroid secretion in the animal, and these substances were supposed to be directly antagonistic to thyroid secretion. It is possible that this may be so, but there has never been advanced any very satisfactory evidence in respect to it. The serum has been prepared for use so that it may be given as a dried powder by stomach or it may be administered subcutaneously in the same fashion as any serum. When given by stomach, doses of from 2 to 5 gr. three to six times a day have been given, and the dosage of serum has varied from 2 to 10 c.cm. each day. The milk has been given as a dried powder in capsules, doses going up to 15, 20, or 30 gr. a day. These substances have probably had the widest use of any of the recent medical measures advocated in the treatment of Graves' disease, and it is not to be doubted that they have produced a certain amount of beneficial effect. In some instances they have acted with almost the certainty of a specific, and the literature contains many reports of very decided therapeutic benefit having been obtained. However, the effects are generally not permanent and are only satisfactory to a small degree. I have seen a number of instances of what appeared to

be a definite cure from undoubted Graves' disease by the use of this form of treatment, but in a very much larger number of cases there has been only small benefit, if any, and this over only a short period of time. The administration of these substances is a simple matter, and they can, like the hydrobromate of quinine, be combined with the usual rest and tonic treatment. In 20 to 30 per cent. of cases their use may be followed by very definite and fairly satisfactory improvement.

Thyroid Preparations.—When it was found that thyroid extract had such a remarkable effect upon myxedema, its use was advocated in all those conditions in which the thyroid gland was in any way involved, and cases of Graves' disease were treated with it. As might be expected, a large percentage of them were made very much worse. Even to-day it is not uncommonly used in the treatment of typical Graves' disease. In a large percentage of these the patient is made very much worse and all the symptoms markedly exaggerated. This is in no way surprising. The thyroid which is given is merely added to that which is produced by the patient's own thyroid, which is already overactive. Nevertheless, it occasionally happens that an atypical case is treated in this way with the very best results. Some therapists have gone so far as to state that in a large percentage of Graves' cases the thyroid is overactive as a result of a kind of compensatory mechanism, and that the administration of thyroid in such cases will prove of decided relief to the patient's own gland. I have never been able to agree with such an explanation, nor have I, in typical cases of Graves' disease, been able to see decided beneficial therapeutic effects follow the administration of thyroid. There can be no doubt that in many of the atypical conditions which have passed from the simple type of hyperthyroidism, and are approaching a myxedematous condition, or in those instances in which apparently some other of the ductless glands is at fault, administration of thyroid may be of benefit. However, the differentiation of these cases is at present in an unsatisfactory condition, and thyroid should be used very carefully in any patient showing decided symptoms of hyperthyroidism. The enlarged glands, accompanied by very mild symptoms, which are occasionally found in young women who have undergone a period of unusual physical or mental overwork, may return to normal size and function somewhat more quickly if to the usual rest and tonics necessary to these patients there is added a very small amount of thyroid extract.

It has been my fortune to see a very large number of patients who have been maltreated with thyroid extract, and as a result of this I may perhaps be somewhat pessimistic in regard to its virtue, but in my opinion typical cases of Graves' disease should be given thyroid extract only by a man who has had considerable experience in treating these cases, and then only when he can have them under his immediate observation.

X-rays.—The x-rays have been used a great deal in treating all forms of thyroid enlargement, including those showing the symptoms of hyperthyroidism. When properly used they appear to be an agency of considerable value, and when there is, in addition, a marked enlargement of the thymus, which can be definitely diagnosed, they may be

advocated as a very effective means of reducing this organ to normal size. I have occasionally recommended their use as a preliminary measure to operation. They should be given by a man who has had a good deal of experience in the use of *x*-rays. Exposures should not be more than one in four or five days, and the condition carefully watched. In 4 instances its use has been followed by a very definite and marked exacerbation of the symptoms of the disease.

Cytotoxic Serum.—In addition to the general measures which have been discussed heretofore, there remains one further means of specific therapy in which I have personally been very much interested, and in the use of which I have had more experience than in the other methods outlined above. This is a cytotoxic serum prepared by inoculating rabbits or sheep over a period of six to ten weeks with nucleoproteid and globulin of a human thyroid gland. The basis for this treatment is twofold: First, the symptoms of the disease are, in large part, directly due to an absorption from the thyroid gland of an abnormally large amount of thyroid secretion. It seems hardly necessary in this place to argue this point. The surgical treatment of the disorder, which in the hands of especially competent men has yielded such excellent results, is based directly upon the same proposition. The secretion is of a proteid character. It probably has a definite chemical make-up, which serves to distinguish it from other proteid substances circulating in the blood. Because of its peculiar construction and its combination with iodine, it has certain very definite physiological actions. When excess of this proteid substance escapes from the thyroid gland into the circulation, symptoms result. The second proposition is this: By means of the usual method of inoculating nucleoproteids into animals of alien species it is possible to get a serum which has so marked a selective action that when reinoculated into an animal of the same species from which the proteid was obtained, it will combine and act by preference upon that organ which has furnished the proteid. In other words, it has a specific effect. This question, as to whether a specific serum can be made which will act primarily upon a selected organ, has long been the subject of debate. In my judgment, it is possible to produce a serum which, as far as we can judge, shows a specific effect with reference to the speed and completeness of its reaction with its antigen. If we accept these propositions, there is the same reason for treating Graves' disease by a serum prepared in this fashion that there is in treating diphtheria by antitoxin.

The various steps in the production of this serum are briefly as follows: The fresh, human thyroid glands, which must not be preserved in formalin, alcohol, or any substance which coagulates the albumin, are ground to a very fine pulp and extracted in several times their volume of salt solution made faintly alkaline with sodium hydroxid. Extraction is carried on in a refrigerator for from twenty-four to thirty-six hours, and chloroform or thymol may be added to prevent bacterial growth. The coarser particles in the extract are then removed by straining through gauze, the filtrate centrifugated and filtered through

paper. A clear extract may be readily obtained by filtering the strained extract through a Buchner funnel filled with paper pulp. We have found that a very convenient method for precipitating the proteids from this extract is to acidify with acetic acid to a concentration of 0.1 per cent., add a sufficient amount of saturated sodium chlorid solution to make the concentration of the salt in the extract 10 per cent. of saturation, and then heat to 44° C. for half an hour. Under these conditions we obtain an abundant flocculent precipitate which may be readily washed, redissolved by the addition of a small amount of alkali, and reprecipitated by the addition of acetic acid. The proteid is redissolved and reprecipitated three times, and is thoroughly washed each time. The purified proteid is dissolved in alkaline salt solution for inoculation into the peritoneal cavity of the rabbit or sheep in which we develop the serum. From five to eight inoculations one week apart are given to each animal before the blood is withdrawn and the serum prepared in the usual method.

During the last three years I have had the opportunity to direct the treatment of between 800 and 900 cases of Graves' disease by means of this serum, and the results have been so satisfactory that I believe it will take its place as a standard therapeutic means in this disorder. If it were not possible for other observers to carry out the treatment and observe the same decided favorable effect as I have personally, I should feel very grave doubt as to the value of the method, but it has been used by clinicians all over the country, from Maine to California, and the results which they have obtained have been quite uniform with my own.

If the classification given in the earlier part of the paper is considered, it will be noted that in groups 1 and 2 is included a large number of Graves' patients. In these two groups serum treatment shows its most favorable results, and 75 to 80 per cent. of them may be absolutely cured. In groups numbered 3 and 4 we have patients who have evidences of thyroidism, but they are not the simple plain types of the first two groups, and in them particularly serum treatment alone is not so successful. It is necessary to continue it then with other therapeutic measures, an important one of which may be the administration of thyroid extract. Serum treatment may need to last for at least a year, in some cases more than that, in order to give final satisfactory results. However, in the majority of cases a very decided improvement may be seen within the first three or four weeks, and in many cases within the first week there is a decided relief from all the distressing features of the disease. The serum is always given by hypodermic injection and the dose and frequency of injections varies with the type of the disease. In the beginning of treatment it is my custom to give a small dose each day for the first three or four days, this dose being from 5 to 10 minims. Following this a dosage of 10 to 15 minims should be given every second day for, perhaps, a month. In case the symptoms are yielding at this time, the interval between injections may be increased to three days, and gradually increased as the patient improves, until at the end of eight to ten months serum may be given every two or three weeks. A

reaction at the point of injection generally follows the beginning of the treatment.

In 95 per cent. of the injections the local reaction consists only of an area of hyperemia and slight induration, which may be somewhat tender on pressure for a few hours. It quickly clears up, and in thirty-six to forty-eight hours the arm is perfectly normal. The indurated area may in some instances be 3 or 4 inches in diameter, and occasionally the whole arm has become edematous from the shoulder to the finger-tips. Such a reaction is unpleasant, but fortunately it is a rare complication, and if the arm is wrapped in a wet dressing the reaction subsides without unpleasant after-effects. The exact nature of the reaction in any given case cannot be foretold, because the matter of personal idiosyncrasy of the patient is an exceedingly important factor. It is best, therefore, to start with a small dose and to determine the nature of the reaction in each case before the full therapeutic dose is attempted. As has already been stated, the very acute toxic cases take the serum better than the mild cases, and with them it may be best to begin with a full dose. If the local reaction is marked, it is best to keep hot applications on the arm for one-half to three-quarters of an hour after the injection, and gently massage the area about the point of puncture. Unless some quite unusual condition results, no further treatment is necessary, for the condition subsides promptly. If a second injection is made before the reaction from the first has subsided, a more decided reaction is produced in the second instance, and the area of the first injection is again excited. The local reaction is, therefore, of value as a guide in the determination of dose and frequency of administration. The two arms should be used alternately as the site of injection.

The general reaction likewise shows considerable variation. In a large percentage of cases there is no disturbance whatever; there may be, however, a slight rise in temperature, accompanied by nausea, some restlessness, and perhaps some increase in the tachycardia. Rarely, the patient may vomit and all the symptoms of the disease be temporarily exaggerated. If the serum is given too frequently or in too large doses, both the local and the general reactions become more severe. The serum must never be pushed in the presence of a progressively increasing reaction. Serious consequences may arise if this precaution is not observed. If, during the course of treatment, an unusually severe reaction has been obtained, it is best to allow a somewhat longer interval before the next injection, and at the same time to reduce the dose.

It is not very unusual to find patients who combine hyperthyroidism with some evidences of hypothyroidism, and their treatment from any standpoint is a matter of difficulty. The work of the last few years has served to indicate how complex a matter some thyroid disturbances may be, in that other ductless glands take part in causing the symptoms, viz. the thymus, adrenal, pituitary, and occasionally the pancreas. There is no question that these glands have functional interrelationships which may be very important. Concerning the precise mechanism of these relations we are yet quite ignorant. Below is given a table in

which are contrasted some of the more striking manifestations of hyper- and hypothyroidism, and these may help to differentiate types of cases which require quite different therapeutic efforts.

HYPERTHYROIDISM.

HYPOTHYROIDISM.

Age.

More common in young women, eighteen to thirty years.

More common in advancing years, thirty-five to fifty.

Onset.

May be slow and gradual or sudden and acute.

Slow and gradual, in many cases engrafted on an old Graves' disease.

Heart.

Tachycardia 120 to 180; pounding beat felt over wide area; often a loud systolic murmur over apex, base, and along the great vessels. Irregular and very susceptible to the effects of exercise. Blood-pressure variable, generally low, pulse soft and full, marked dyspnoea on slight exertion. Marked edema of legs.

Rarely above 100, may be irregular with heaving impulse. Pulse generally above high tension and the blood-pressure is above normal.

Nervous Symptoms.

Fine tremor, affecting nearly all the muscles, twitching, and occasionally spasms. Patients are abnormally irritable and excitable, apprehensive, mentally *very* active and physically restless. Muscular weakness prominent.

Patients may have some tremor, and muscular weakness is likely to be very pronounced, but there is not the same restlessness and jactitation. Patients are occasionally irritable, but they are generally rather dull and apathetic, mentally slow; memory defective. Pains in joints frequent, and there is a marked tendency toward sudden giving way of the legs when walking.

Eye Signs.

Exophthalmos generally present, although it is not invariable. Occasionally unilateral, corresponding to the side having the enlarged thyroid lobe. Various symptoms arise in consequence of the exophthalmos. No pupillary changes.

Exophthalmos is unusual, although it may have been present at one time.

Gland.

Enlargement varies from nothing to very large goitre. The bloodvessels over the gland are generally much enlarged and pulsate markedly. Right lobe generally the larger.

Often no enlargement can be made out; when there is a goitre it has an elastic, rubber-like consistence, occasionally cystic and nodular, but very distinctly different from the active pulsating gland of Graves' disease.

Nutrition.

Severely disturbed; in most cases there is a loss in weight, which may progress to extreme emaciation. Appetite variable; vomiting and diarrhoea, frequent complications. Patients drink a great deal of water.

Generally not seriously disturbed; patients hold their weight and in most cases gain slowly; constipation rather than diarrhoea, and flatulency a troublesome habit. Patients do not drink much water.

HYPERTHYROIDISM.

HYPOTHYROIDISM.

Skin.

Profuse perspiration, erythema, urticaria, dermatographia; pigmentation, which may occasionally be so marked as to suggest Addison's disease. Hair falls out, but is not coarse and dry. Patients prefer thin clothing and cold rooms. They are more comfortable during cold weather.

Dry, may be scaly; patients do not perspire on exertion; hair dry, brittle, scalp scaly. Pigmentation not common. Patients prefer thick, warm clothing and are cold most of the time. Much more comfortable during hot weather.

Temperature.

May be only slightly elevated, 99° to 100° F. With severe acute cases it runs often to 102° to 104° F.

Subnormal, may reach as low as 95° F.

Urinary Findings.

In most cases normal in volume; glycosuria not unusual; polyuria often observed in later stages. Nitrogen partitions show a very much decreased kreatinin excretion, while kreatinin is present in large amounts. Nitrogen loss is marked during the period of emaciation.

Albuminuria not unusual. Nitrogen partitions do not show so marked a disturbance in kreatinin and kreatinin ratios. In large number of cases urine practically normal.

Blood.

Hemoglobin low, leucopenia in severe cases, with a marked relative lymphocytosis.

Hemoglobin low, white blood-count normal.

Menses.

Very irregular or completely suppressed.

Generally regular, but scanty.

In a considerable number of these combined cases it has been our experience that the administration daily of a small amount of thyroid proteid, three doses of $\frac{1}{50}$ gr., and the injection of a small amount of serum, 5 minims every third day, gives the best results. It is not easy to understand precisely why this is true, since it is paradoxical to believe that a hypothyroid condition exists in the same patient that has symptoms of hyperthyroidism. It may be that the thyroid proteid from a normal healthy animal answers the physiologic need of the patient for such a secretion, while the abnormal product from the patient's own gland is neutralized by the use of serum. It is certain that the serum does not neutralize the physiologic action of a sheep thyroid proteid; so that in effect we may, by giving serum and the proteid from normal sheep thyroid simultaneously, substitute the action of the normal secretion from the animal for that of the abnormal secretion from the patient's gland. Whatever may be the explanation, the clinical fact remains that some of these mixed cases improve more rapidly and surely by such a method of mixed treatment.

It is impossible to formulate precise rules to be followed in administering serum to this group of patients, for the reason that the type and clinical conditions are so variable, but from a study of the case we may be able to decide whether the symptoms are a manifestation of hypothyroidism or hyperthyroidism, and the beginning of the treatment should

be made in accordance with these conclusions. In my opinion, the logical treatment for the group of mixed cases is the combined treatment, as it combats the dysthyroidism, which is probably an essential factor in the production of the symptom-complex. The treatment of the atypical and the advanced typical cases requires a finer discrimination and more accurate judgment in the employment of antiserum and thyroid preparations than is needed in the treatment of the typical cases which form our first group, and it must be admitted that some degree of experimentation must be made with some of these patients before the most suitable treatment is determined on. Complete recovery is slow, but encouraging improvement is often noted in a comparatively short time.

Before we can give treatment intelligently in cases belonging to this group a very careful study must be made of the past history of the disease, the symptoms, and the clinical condition, in order to determine, if possible, whether the hypothyroid or the hyperthyroid defects predominate, for our therapeutic efforts will be regulated accordingly. The manifestations of these two conditions are so complex and our means of diagnosis so incomplete that we cannot always decide in which group a given patient belongs. In most instances it is possible to classify the case, but occasionally we find one of a mixed type that is very difficult to explain.

With certain phases of the disease, in which there may be a very marked pigmentation of the skin and quite marked gastro-intestinal disturbance without a corresponding nervousness and cardiac complication, the proteid from the adrenal gland is very efficacious. Its further use is now being investigated, but at present it is hardly possible to say more than that in some types of cases which have manifestations which in some degree relate them with Addison's disease the administration of adrenal proteid gives satisfactory results. In others, where there is a marked nutritional disturbance, loss of weight, and decided weakness, some form of pancreas proteid may be of some value, but these therapeutic measures are as yet too poorly defined to form a portion of a text-book.

THE TREATMENT OF CRETINISM AND MYXEDEMA

The administration of thyroid extract to cretinous children and myxedematous adults is one of the best examples of specific medication known to therapeutics, but it is unquestioned that a very much wider use could be found for thyroid extract in these cases if the diagnosis were extended to include those cases which show only a very mild disturbance in the line of a hypothyroid condition. There are undoubtedly going about the country to-day a great many more myxedematous individuals, being treated for some other disorder, than there are who have been recognized and are now being treated on the basis of a correct diagnosis. It seems as though only the most advanced of these cases is recognized, but there is no question that the thyroid function has very wide variations in its quantitative aspect. We cannot sharply differentiate all

classes of individuals into three groups, those who are hyperthyroid, normal, or hypothyroid. Mild symptoms of hypothyroidism are not at all uncommon. A little slowness of speech, lack of ambition and desire to be about and doing things, a tendency to take on flesh, and occasional unexplained swellings about the face, shoulders, and ankles, which last only a few hours, slight dryness of the skin, may be evidences of deficient thyroid function, and such persons often improve wonderfully by small doses of thyroid extract.

With the treatment of well-defined forms of cretinism and myxedema only certain statements seem necessary. We have nothing in the line of therapeutics which may be used as a substitute for thyroid extract, and thyroid administration will need to be a continuous feature with these individuals to a greater or less degree during a large part of their lives. They must be under careful observation. With them the general treatment must not in any way be neglected, and it must be remembered that they are often much more sensitive to thyroid administration than a normal individual who apparently has full thyroid function. It is not unusual to find a myxedematous patient who cannot take more than 6 to 8 gr. of thyroid in a day. One of the chief difficulties which has heretofore operated in the treatment of these cases has been the lack of uniform thyroid extract. The writer during the last three years has used invariably a thyroid preparation made from pure proteid and standardized by means of its iodine content.

THE THYMUS GLAND

During the last five years a considerable amount of experimental work has been done upon the physiology of the thymus gland. Some of the facts attained by this study have been referred to in the chapter on Glandular Therapy. The most complete study which has any immediate reference to diseased conditions associated with the thymus is the study made by Basch. He states that during many years of investigation the effects of the removal of the thymus gland in young dogs had been observed, and he noted that they were often seized with general convulsions, from which they died. Cramps occurred suddenly, were sometimes tonic and sometimes clonic. As the controls from the same litter did not develop convulsions, it would seem that these cramps must be related to the removal of the thymus. He found that animals without a thymus showed very marked changes in the bony system, with decrease in the rate of growth and with marked loss of intelligence. It is his belief that the administration of thymus causes a marked increased irritability of the cortex. He found that the direct application of calcium chloride to the cortex diminished this marked irritability and from the basis of these rather extensive experiments, which cannot be noted in detail here, he builds an argument for the origin of the tetany in children. He states that the symptoms following the removal of the thymus more nearly resemble the phenomena of clinical tetany than the symptoms produced by the removal of thyroid and para-

thyroid. He also states that in animals which show this marked irritability administration of thymus and suprarenal very markedly control these disturbances. The symptoms following removal of the parathyroids set in almost immediately, while those following removal of the thymus more nearly resemble the symptoms of tetany in children. He did conclude, as a result of these experiments, that the thymus administration may be of decided value in the chronic tetany. Most of the work, it must be admitted, the last few years has more decidedly related symptoms of tetany with the parathyroid gland. These observations of Basch have not been in all respects confirmed. We do not have a decided scientific foundation for the administration of thymus in tetany, but it probably has the merit that it will do no harm. The thymus gland in children is occasionally so large that it causes very marked pressure symptoms, and during coughing or crying the thymus gland may cause very marked pressure upon the bloodvessels in the neck, with resulting symptoms of cyanosis with dyspnoea and fainting. It seems probable that these symptoms are quite as readily explained by pressure upon the bloodvessels as by pressure upon the trachea, causing obstruction to the respiration. Medical measures are of very little avail in these conditions. The thymus gland must be removed surgically or a condition of atrophy must be induced by treatment with the x -rays. Both methods have been used extensively and both apparently give good results. The gland must be entirely removed, as in some reported instances severe nutritional disturbances ending in death have followed such surgical procedure. The thymus gland apparently plays some important role in that condition known as status lymphaticus. At autopsy the gland is always found enlarged and active. Lymph-nodes through the body are likewise enlarged. These two structures undoubtedly play an important part in the condition. It can scarcely be said that any intelligent therapeutic measures have yet been advocated for status lymphaticus. The diagnosis is not usually made except at postmortem. If the diagnosis is made during childhood, tonic and dietetic measures may be of value, but there is no specific therapeutics for the condition. It undoubtedly plays an important part in the susceptibility of many individuals to infectious disease. Various remedies, such as iron, arsenic, glandular extracts of thyroid and adrenal, have been advocated in its treatment. Because there seems to be some interrelation between the functions of the thymus and the sexual glands, extracts of the sexual glands have likewise been given, but the therapeutic possibilities are meager and unsatisfactory.

PART VI

THE TREATMENT OF DISEASES OF THE NERVOUS SYSTEM

DISEASES OF BRAIN, INSANITY, APOPLEXY, DISORDERS OF SLEEP, HYSTERIA, NEUR- ASTHENIA, DISEASES OF SPINAL CORD AND NERVES

By D. J. McCARTHY, M.D.

HEADACHES.

Headache, like insomnia, should always be considered a symptom and not a disease. It may, however, dominate the clinical picture to such an extent as to constitute an entity. In other words, the patient applies to the physician especially for the treatment of his headache. It may be the symptomatic manifestation of some serious visceral disease, some chronic disturbance of metabolism, or some exogenous or endogenous intoxication. Rarely it may be the manifestation of a local neuritis of some one of the cranial nerves or branches of the cervical plexuses, or the manifestation of some local disease of the bones of the skull. Not infrequently local headache is due to muscular rheumatism affecting the fibers of the occipitofrontalis.

There has been much discussion as to the exact nerves involved in the production of headache. There are those who hold that the headache is due to pain manifestations in the course of the fifth nerve; others hold that the sympathetic is responsible, and still others that the pain of headache is due to irritation of the brain substance by variations in the circulatory pressure. It is quite possible that all these theories are correct. No single one of them, however, will explain sufficiently all headaches. There is a so-called group of congestive headaches in which the head feels full, the veins of the forehead are markedly distended, and in which distended veins can be seen through a trephine opening. Marked grades of cerebral congestion may exist over long periods of time in right-sided heart disease without necessarily producing headaches.

For purposes of treatment we may divide headaches into the following groups:

A. Headaches due to local causes about the head.

1. Rheumatic headache.
2. Headache due to disease of the bones of the skull and the perosteum and bony sinuses.
3. Headaches due to neuralgia or neuritis of the cranial nerves.

B. Headaches due to diseases of the brain or its appendages.

1. Meningeal headaches; headaches due to diseases of the meninges.
2. Headaches due to diseases of the brain (tumor, abscess, encephalitis, acute hydrocephalus, etc.).
3. Headaches due to vascular disease (anemia, congestion, aneurysm, arteriosclerosis).
4. Headaches due to diseases of the cranial nerves in their intracranial course (tumor of the Gasserian ganglia, trifacial neuralgia, etc.).

C. Toxemic headaches.

1. Exogenous toxins, such as lead, tea, coffee, alcohol, etc.
2. Toxins of the infectious fevers, typhoid, influenza, malaria, syphilis, etc.
3. Toxins of disturbed metabolism, such as lithemia, uremia, diabetes, etc.
4. Toxins from visceral disease (heart, lungs, liver, kidney, gastro-intestinal tract).

D. Reflex headache.

1. From eye-strain, diseases of the eye, ear, nose, and throat.
2. From the gastro-intestinal tract.
3. From pelvic disease.

E. Headache due to functional nervous diseases, neurasthenia, hysteria, etc.

The diagnosis of the causation of a headache may be the simplest or the most difficult problem presented to the physician. In many if not the majority of cases a large functional element in addition to the actual cause of the headache is present. Not infrequently a headache habit is developed; this is especially true of periodic headaches. On account of this large functional element it is advisable that a complete and thorough examination of the case be made before treatment is begun. A careful and painstaking history embracing the details of the life of the individual, his detention at work, the family life, the use of the eyes, mental and nervous overstrain, the diet, the bowel movements, the use of intoxicants, tea, coffee, and tobacco, and any other details developed by the above classification should be carefully investigated. A painstaking clinical examination should then be made, including an examination of all the viscera, careful stress being laid not only on pathological lesions, but also on functional disturbances. The urine should be carefully examined, not only for sugar and albumin, but as to the total quantity, the acidity, the presence of indican, etc. The bowel movements should also be the subject of careful laboratory investigation. The eyes, ears, nose, and throat and the pelvic organs should be carefully investigated by specialists along these lines. Whenever any deviations from the normal are noted,

they should be corrected immediately and the case treated as a whole rather than by piecemeal. By this I mean that one single factor should not be corrected and the rest left in abeyance, for the simple reason that if these are not corrected and the headaches persist, the patient begins to lose confidence, and the important psychic element in the treatment is lost. It is sometimes advisable to change from one specialist to another when special organs are involved. An able eye specialist will fail for some reason or other at proper correction, whereas another with slightly different methods will be immediately successful. It will not be necessary to consider the symptomatology of all the headaches in the above classification; there are, however, some characteristic symptoms in some of the simple forms of headache which will need description.

A. Headaches Due to Diseases External to the Brain.—Rheumatic Headaches.—Rheumatic headaches may be either simple, localized affections of the muscles of the scalp, or fibrous aponeuroses, or of the supporting muscles of the head; or, on the other hand, they may be due not only to this local condition, but also to a lithemic toxemia, an auto-intoxication from the disturbed gastro-intestinal tract, or to disturbed liver and kidney function. I have also seen congestion of the tonsils and the pharynx acting as an important contributing factor. The local condition may be the result of exposure to cold, sudden checking of the perspiration, or the gradual accumulation of the so-called rheumatic poisons in the system, from lack of exercise, overfeeding, and the use of alcohol. The pain is usually of an intense aching character, with marked tenderness over the scalp. This tenderness may be so marked as to prevent the patient from combing the hair. There is sometimes a slight elevation of one or two degrees in temperature when the headache is most intense.

There is an occipital type of headache with slight tenderness at the nape of the neck and slight induration of the other tissues, with so-called gouty nodules due to the same cause. The treatment of this type of headaches is the treatment of *lithemia*. The regulation of the exercise, of the diet, the elimination of alcohol and coffee, the use of large quantities of water, the correction of the general nerve tone of the patient, the use of salicylates, aspirin, colchicum, and the iodides. After the acute symptoms have subsided, local and general massage are a distinct benefit. Hydrotherapy will be found of much value; the use of the Russian or Turkish bath combined with properly prescribed exercise, or a sojourn at one of the springs, such as Saratoga, Mt. Clemens, Bedford Springs, in this country, or Carlsbad, Franzensbad, etc., on the Continent, usually gives beneficial results.

Syphilitic or tuberculous disease of the bones of the skull need only be mentioned. There is usually marked tenderness on pressure and a baggy, fluctuating swelling; not infrequently, multiple areas are present. In tuberculous cases, localized abscesses not infrequently result. They will require surgical interference. I recently saw one such case mistaken for an oncoming tuberculous meningitis. Syphilitic cases usually react promptly to mercurial treatment either by hypodermic medication, or the local use of mercury over the scalp. "606" has given immediate

relief in some cases. If neglected, necrosis with suppuration will necessitate surgical interference. Acute and chronic inflammatory conditions involving the trifacial nerves will be considered later.

The headaches of acute *meningitis* need not be considered here. Persistent headaches complicating tuberculosis should always suggest the possibility of a beginning meningitis. One need not wait long for confirmation of this diagnosis. I have found headaches of advanced pulmonary tuberculosis more frequently due to the use of the eyes for fine work, when the eye muscles are weakened from the general wasting process. Chronic passive congestion from an overstrained right heart and persistent dyspnea is sometimes the cause. In other cases the kidneys are responsible.

In chronic meningitis there is usually some evidence of the nature of the process in the involvement of the cranial nerves. This has already been considered under meningitis. In brain tumor, brain abscess, and acute internal hydrocephalus a careful examination of the eye-grounds, with a consideration of the other nervous symptoms, will reveal the nature of the process.

Anemic Headache.—There is unquestionably a headache due to a deficient supply of blood to the brain; this is sometimes found in the simple, the essential, and the secondary anemias of marked grade. The term anemic headache is, however, most often applied to a different condition; *i. e.*, a temporary vasomotor disturbance with a cutting off of the usual blood supply. There is some evidence to support this assumption. Patients with headaches of this type not infrequently suffer from tinnitus aurium, vertigo, insomnia, etc.; the pupils are usually dilated, and the ophthalmoscope may show a pallor of the optic nerve and retina. A large percentage of these cases are of a neurotic type, with low nerve tone, constipation, irregular heart action, and are easily fatigued. In other words, we are dealing here not only with a possible circulatory disturbance, but with psychic, toxic, and reflex factors as well. Headaches associated with the menstrual period have been assigned by some authorities to this group. A few may belong there, but the vast majority are due to reflex and complex toxic causes.

The treatment of this group is for the most part constitutional. When there is actual anemia the blood picture may be restored to the normal by proper measures. The rest treatment will be found advisable in some cases; a change in environment and life in the country, or a period of foreign travel, will answer in others. In cases of subnutrition, overfeeding will be found advisable. For this purpose the Flick diet has the advantage of not only improving the weight and general nutrition, but frequently relieves a chronic constipation. In weakened heart action, digitalis or one of its preparations will be found advisable when the blood pressure is below the normal. Properly regulated exercises in flabby patients will add to this effect. In some patients the respiratory excursion is markedly diminished. Much benefit will be found in properly guarded breathing exercises. An active life in the fresh air, with plenty of sunshine, proper regulation of the life and the bowels will often give better

results than the administration of drugs. Alcohol has been advised in this group of cases; sometimes it does good, more often it does harm.

B. The Headaches of Cerebral Congestion.—This may be of two types, an active and a passive. Headaches of active cerebral hyperemia may follow violent excitement, physical overexertion, the excessive use of alcohol, etc. A headache of the above type is sometimes noted in full-blooded individuals who are above normal weight and addicted to the excessive use of food and drink. There is often in these cases a gouty element.

Persistent headaches are sometimes due to passive congestion. In chronic right-sided heart disease, chronic pulmonary disease with strain on the right heart, bronchitis, pneumonia, whooping cough, a passive congestion may lead to disturbance of the circulation, and cause pain in the head. In congestive headaches the pain is throbbing and usually involves the entire head; the arteries are hard and pulsating, and the superficial veins are distended and tortuous. The pain is increased in the recumbent posture and in lowered positions of the head. In active hyperemic headaches, tinnitus aurium with flashes of light are noted. In advanced heart and pulmonary disease, hallucinations of hearing and vision may be present. In studying congestive headaches it should be borne in mind that the cerebral arterial and venous system are a part of one and the same system—the supply of blood to the brain and its withdrawal. Any mechanical condition in the chest which interferes with the return of the supply to the brain produces a stasis which needs an increased arterial pressure to overcome it. This produces a disturbance which may lead not only to a full feeling in the head, with headache, but also to a slow mental reaction with confusion of ideas, hallucinations, and even delusions. A form of congestive headache somewhat difficult of explanation is that following exposure to the sun, in those who have suffered from heat-stroke. Such patients are extremely sensitive to high temperatures, and the headaches so produced have all the characteristics of acute congestion.

The treatment of the acute attack of headache should be directed toward the relief of the congestive process. In some cases nature affords prompt relief by a spontaneous epistaxis. Glasgow induces epistaxis by pinching the cavernous body of the nose. If the headache is intense and needs prompt relief, the bowels should be freely opened by divided doses of calomel followed by a saline. Good results are sometimes obtained by the use of a hot mustard foot bath and the application of cold to the head by a roller bandage or Esmarch rubber bandage. A combination of aspirin, phenacetin, or acetanilide with sodium bromide often gives immediate relief. The salicylate of soda in some cases gives better results than aspirin. Ergot has been recommended in this form of headache, but I have not had sufficient experience with it to speak of its value. Galvanism properly applied will often give good results. The cathode should be applied over the sympathetic cervical ganglia, or at the nape of the neck, and the forehead and eyes gently stroked with the anode. In all of these cases a visceral cause should be sought for, and any obstruc-

tion to the flow of return circulation promptly relieved. The headaches of cerebral aneurysm resemble in their throbbing character those due to simple cerebral congestion. If the aneurysm has grown to appreciable size a murmur may be heard over the skull, and examination of the eyes may disclose choked disk and other pressure symptoms.

Persistent headaches are sometimes noted in cerebral *arteriosclerosis*. They may be due to high arterial tension, or may, on the other hand, result from cutting down the blood supply to localized brain areas. They are frequently an early symptom of an oncoming hemorrhage or thrombosis. Treatment of the headache depends upon the blood pressure, the activity of the heart, and the grade of myocarditis. If the blood pressure is high, rest in bed, massage, saline purgation, and the nitrites in ascending doses may be given until the desired lowering of the pressure is secured. In conditions of hypotension, cardiac stimulation by means of some of the preparations of digitalis may be indicated. A combination of *nux vomica* and the bromides will often be found advisable.

C. Toxemic Headaches.—It is hardly necessary here to consider the headaches due to the excessive congestion caused by alcohol. Headaches which result from tobacco may be due to the direct toxic effects of tobacco on the nervous system, or may be secondary to irritative and congestive conditions of the upper respiratory tract. Not only tobacco, but also tea and coffee are much more prone to produce headaches when acting on a gouty basis or when acting in combination with eye-strain. The headaches of the infectious fevers need only be mentioned. It should, however, be noted that not all intermittent headaches are malarial in nature. Post-influenzal headaches not infrequently follow this type; the pain of trifacial neuralgia is sometimes distinctly intermittent. Headaches may sometimes occur in the late afternoon as the result of fatigue and lack of nutrition. Working-girls, who eat little or no food at mid-day, not infrequently suffer from headache in the late afternoon. These promptly disappear with proper food and short rest at the mid-day period. Malarial headaches need not, on the other hand, be of an intermittent nature, but more or less constant during the day. A headache present in the morning when the patient awakes is strongly suggestive of an intoxication from the kidney; it may, however, be due to eye-strain or overuse of the eyes far into the night. The blood examination should differentiate a malarial from other intermittent types of headache. The treatment of this headache is the treatment of malaria by the use of quinine and constitutional treatment to improve the constitution of the blood and the general nutrition. The treatment of the headaches due to lithemia, uremia, diabetes, etc., is the treatment of the underlying cause.

Dyspeptic or Bilious Headache.—Disturbance of the function of the gastro-intestinal tract and its accessory viscera is frequently an essential or contributing cause of headache. Constipation may persist for years without producing the slightest trace of mental hebetude or pain in some individuals; in others, a moderate grade of constipation lasting only a few days will cause severe symptoms. Chronic gastric or intestinal indigestion

with or without constipation may be associated with persistent headache. The so-called bilious headache, popularly referred to as a torpid liver, is associated with constipation, clay-colored stools, lassitude, mental hebetude, and dull head pains. The headache is usually frontal as to location, and may be associated with nausea, vomiting, flashes of light, and vertigo. During the paroxysm, citrate of caffeine, bromide of soda, and Fowler's solution may be administered. Divided doses of calomel with soda will not only control the nausea, but by free purgation will relieve the underlying cause. This should be followed by a saline, and for several days the bowels should be kept freely opened by the use of phosphate of soda. The recurrent attacks should be prevented by a regulation of the diet, outdoor exercise (preferably walking, golf, or riding), abdominal massage, and the evacuation of the bowels, assisted at first by the use of laxatives if necessary.

D. Reflex Headaches.—Simple reflex headaches are relatively rare. The reflex causes usually act upon a neurasthenic basis, or in combination with disturbance of the gastro-intestinal tract, visceral disease, etc. There is no question, however, that simple eye-strain may give rise to violent headaches, and in growing children may interfere with the development of the child, mentally and physically. This is equally true in adolescent girls who suffer from pelvic disease. The vague headaches which are not infrequently associated with pain referred to the gastro-intestinal tract as the result of masturbation in boys can hardly be called reflex in nature, but belong to this same group. It has been explained upon the basis of a sympathetic swelling or edema of the nasal mucous membrane covering the turbinates during sexual excitement. Obstruction of the upper respiratory tract in disease of the nose, nasopharynx, and the tonsils causes not only headache, but also interferes with the mental and physical development of the child, and is a frequent point of infection by the staphylococcus, tubercle bacillus, and other organisms.

Much has been written about the location of these various headaches. While it has been stated that headaches due to eye-strain are sometimes frontal, this is by no means constant. Diffuse headaches or headaches localized to the vertex may result from the same cause. The headaches of pelvic disease are supposed to be referred to the vertex, but in my experience the exceptions are more frequent than the rule. Referred headaches from diseased teeth are sometimes referred to the temporal areas. Sinkler has called attention to the diffuse headaches associated with the cutting of wisdom teeth. In a study of all headaches the possibility of frontal sinus disease should be borne in mind. The presence of an optic neuritis in disease of the bony sinuses should not be forgotten. This has given rise to mistakes in diagnosis of brain tumor. The treatment of headaches due to all of these conditions depends upon the removal or correction of the local irritative process. Headaches due to ear disease demand the immediate and close attention of the ear and nerve specialist. If there be evidence of meningeal irritation or other irritation or involvement of the central nervous system, an immediate and full exploration should be made.

E. Headaches of Neurasthenia and Hysteria.—The treatment of neurasthenia and hysteria will be considered later, and needs no further elaboration. The persistent headaches noted in these functional disorders should not be made the basis of treatment until the general nervous and physical health has been brought to such a level as to render the probability of relief permanent after it has once been secured.

Migraine.—This form of headache has been classified at times under the neuralgic headaches and at times under the toxemic headaches. Migraine is more than a headache and less than a disease. It may, indeed, occur without actual pain. It may be considered as symptomatic of some underlying reflex cause or intoxication. The essential symptom is the pain limited to one side of the head. Migraine may occur at any time of life. It may start early in childhood and persist during the entire lifetime of the patient. The tendency, however, is for a decrease in intensity and final disappearance of the pain after the age of fifty. It is rare for headaches to continue after the menopause, although diffuse headaches of an entirely different character may follow it. Sometimes a neuralgic type of pain limited to the supra-orbital branch of the fifth nerve follows the cessation of the typical migraine headache. In rare cases the unilateral headache may persist with the disappearance of the sensory and special sense symptoms.

A rheumatic, gouty diathesis appears to be the cause of quite a large number of these cases. The same conditions which precipitate an attack of gout will often cause an outbreak of migraine. Usually with the attack of migraine there is other evidence of lithemia. Much has been written on the association with epilepsy. As to the frequency of the association there can be no question. The epilepsy follows, as a rule, after years of frequent migraine attacks; rarely the epilepsy may precede the migraine, and the migraine sometimes apparently acts as an equivalent for the epileptic attack. One of my patients, a woman, who died at the age of forty-two as the result of a cerebral thrombosis, developed, after twenty years of the most severe migraine, Jacksonian epileptic attacks limited to the right arm and face, temporary aphasia, and transient graying of the hair on the affected side at the time of the paroxysm. At the autopsy there was found extensive cerebral arteriosclerosis, with practically no arteriosclerosis elsewhere in the body. The thrombosis which caused the death of the patient was limited to the left Sylvian artery. In this case I think the frequent change in the caliber of the cerebral bloodvessels during the paroxysms caused the arteriosclerosis which in turn was responsible for the convulsive seizures. Some sufferers from migraine show marked anemia. Both the anemic condition and the headaches are in all probability due to the same underlying cause. Eye-strain due to defective correction or overuse of the eyes, even with proper correction, is an unquestionable cause of migraine in some individuals. It accounts for a certain periodicity noted in individuals like clergymen, where overuse of the eyes is limited to a definite period of each week. A lowered nerve tone due to a winter's overwork is a frequent cause in brain-workers.

Constipation frequently precedes an attack of migraine. The attack

may be aborted by prompt and free purgation. It does not at all follow that constipation is the cause of migraine, although intestinal intoxication may be at the bottom of these cases. It is much more likely that constipation is but a prodromal symptom, and prompt purgation not only relieves the intoxication from the gastro-intestinal tract, but acts as a depleting measure in relieving congestion of the cerebral tissues.

In the treatment of migraine it is important to be sure that we are dealing with an actual case of migraine, to study out the possible etiological factors, and to secure as much relief as possible without the use of drugs. Prodromal symptoms are common. A sense of mental and physical depression often precedes the attack for from one to several days. In some cases a mild headache in the morning, increasing in intensity on successive days, gradually precedes the most severe paroxysms. In some cases intestinal disorders, coating of the tongue, feter of the breath, may precede the attack for a day or two. Bulimia preceding the attack has been noted. The food is not the cause of the attack, because fasting at this time does not prevent the occurrence. Ocular symptoms may precede the attack, but are more often coincidental with the pain manifestations. In a case reported by Mitchell, and which was for a time under my observation, the attack was ushered in by an hallucination of a midget in the far distance, who as he approached developed into a giant who beat the patient over the head with a club. The ocular manifestations are usually brief, lasting fifteen to twenty minutes, but they may persist through the entire attack. Scotomata are the simplest of these manifestations. There may be one or more bright spots floating before the eyes, zigzags of light and the so-called fortification lines. There may be blurring of the visual fields, of an irregular outline, or this may take the form of a hemianopsia. In some cases the upper or lower half of the visual field is cut off. Hallucinations of hearing are sometimes present. Hyperacusis is a more frequently associated symptom. The headache begins as a pain over one eye, which gradually spreads to one-half, or finally the entire head is affected. It may remain constantly localized to one-half of the head, but more frequently alternates from time to time. In some cases the pain is localized to the occipital portion of the head. The face may be flushed or pallid, the arteries may stand out as hard, tense cords, with some distention of the veins.

Mental symptoms are not infrequent. These take the form, most frequently, of loss of memory, with some confusion. A peculiar feeling of unreality, of double consciousness, a paraphasia, or a domination of the field of consciousness by a simple word or idea may be present. The pain may last anywhere from one or two to twenty-four hours; it increases in intensity, and there is nausea and vomiting. The pain is usually intensified by the act of vomiting, but is followed by a diminution of the pain, so that the patient falls asleep and awakens entirely free from it. In some cases the patient is completely exhausted after the attack, but more frequently feels, if anything, better than before the attack took place. This is, however, more of a contrast feeling than an actuality.

The prevention of the attack of migraine depends upon the removal of

the etiological factors, the regulation of the diet, exercise, work, and habit of the individual. In the gouty type of cases an antirheumatic or anti-gouty régime should be ordered. This has already been fully considered. Sufficient out-of-door exercise of a nature adapted to the age and physique of the patient should be prescribed. The gastro-intestinal tract should be kept in good condition and special attention should be paid to the bowels.

Where there is evidence of intestinal auto-intoxication, intestinal antiseptics should be given. Salol, beta-naphthol, or resorcin, in fairly full doses, should be used. Flushing of the large bowel by high enemata will sometimes prove beneficial. All reflex causes, such as eye-strain, disease of the nasopharynx, etc., should be removed. Hydrotheraphy is of much value in some cases, more particularly those with a rheumatic or gouty basis. A Turkish bath once a week, if well borne, and a hot vapor or tub bath assist in the elimination of toxic products. This should be combined with massage of from twenty minutes to half an hour. If the patient is under weight, forced feeding may be necessary in order to bring the nutrition up to normal. Many drugs have been heralded as specifics for the treatment of pain; the best of these is *cannabis indica*, which should be given at first in small doses of the freshly made extract, and gradually increased, stopping short of the physiological effect. Another drug of much value is caffeine. This should be given in full doses, of from two to three grains every four hours, during the attack. Ergot will prove beneficial in a small group of cases, and this may sometimes be combined with the bromides. If the paroxysmal pain lasts well into the night, I have found much benefit from the use of hypnotics, especially veronal and trional. Five grains of each may be given at nine-thirty or ten o'clock and again at eleven-thirty or twelve if the patient is not already asleep. After a period of sound sleep the patient usually awakes refreshed and free from pain. In the gouty cases, aspirin in doses of seven to ten grains in combination with the same quantity of phenacetin, repeated in two hours, will often give relief. Strychnine with small doses of nitroglycerin may be given at the same time to guard against the depressant action of these drugs, and will often prove efficacious as a preventive if given in the interval between the attacks. In anemic patients the iron preparations sometimes produce excellent results, whereas in others they seem to accentuate the headache. In the latter group of cases arsenic between the attacks may prove of much value.

NEURASTHENIA AND HYSTERIA.

In the treatment of neurasthenia and hysteria we employ for the most part the same measures. It should be recognized that inability to stand the stress of normal life without physical and mental fatigue and nervous irritability may either be a disease in itself or dependent on some latent or active visceral disorder. It is therefore of prime importance in treatment to determine which of these two conditions is present. The treatment must necessarily vary. My experience at the Phipps Institute for

the Study and Treatment of Tuberculosis revealed a relatively large number of cases that had been diagnosticated and treated as neurasthenia. The neurasthenic syndrome may be the only subjective manifestation of a chronic pulmonary tuberculosis. The physical signs may be so slight as to be equivocal, and a careful temperature record may show an elevation of a half to one degree of temperature in the evening, and a positive reaction to a subcutaneous tuberculin test. The toxemia in this and in some healed cases which are still under weight may represent the drag which produces the nervous exhaustion. In these cases the treatment is the treatment for pulmonary tuberculosis. When nervous irritability is marked, when persistent insomnia, excessive fatigue, mental depression and introspection complicate a case of pulmonary tuberculosis, it may become a serious menace to an otherwise favorable case. The pulmonary expert or the general practitioner should recognize that such cases need the services of an expert neurologist.

The neurasthenic syndrome may be a marked manifestation of moderate or relatively advanced cardiac or vascular disease. A moderate to advanced grade of arteriosclerosis may present a condition of mental or nervous exhaustion if too much mental or physical work is thrown upon the circulatory system. These cases require a careful study of the blood pressure. Landis has called attention to the importance of abdominal arteriosclerosis in some of these cases. Kidney disease, more particularly the milder forms of contracted kidney, suggests the importance of a careful study of the urine. Chronic indigestion is the rule in all forms of neurasthenia. Organic disease of the stomach and intestinal tract should, however, be excluded before treatment can be judiciously carried out. In individuals with a finely balanced nervous system, or in those working the nervous system to its full capacity, minor forms of irritation in the eye, ear, nose, throat, and genito-urinary system should be carefully sought for and corrected. I have seen marked cases of exhaustion in such individuals promptly relieved by the removal of irritation from improperly filled or carious teeth. All this means that he who would treat neurasthenia successfully must be prepared by a careful physical examination and chemical analysis to detect minor chronic visceral changes and sources of intoxication from within or without, and as far as possible to correct them. This would appear to be the province of the general practitioner. As a rule, his failure is often dependent on conditions beyond his power to control and which, on the other hand, can be easily arranged under different surroundings by the specialist.

In essential neurasthenia, which may depend upon either a congenital inefficient nervous system or abuse of the nervous system, as when an individual attempts to carry the work of several people with deficient rest, the symptomatology does not differ from that of the secondary form. In the congenital variety equally good results are not to be expected, as in either of the other two groups. I have devoted this space to diagnosis not only because it is essential to treatment, but because a careful painstaking examination and analysis inspires that confidence which is so necessary to successful results.

In functional nervous disease, a case well diagnosticated is half cured. At one time all cases of neurasthenia were treated by the rest treatment. The application of a rational therapy, as applied by Mitchell in his rest treatment, was one of the epoch-making discoveries, if so it may be called, in the development of the treatment of the disease. It still has its great value, but where formerly it was extensively used, it is now used only in well-selected cases. In mild and moderately advanced cases much simpler methods will suffice. The treatment will necessarily differ in the working class and in the well-to-do. It is difficult and often impossible for overworked and neurasthenic schoolteachers, business women, clerks, etc., to give up their employment in order to be cured. This is a condition which must be met by employing the best means at our disposal. The means used to combat neurasthenia may be classified as rest, work, and mental therapy. The working person usually has sufficient work and no lack of interest; indeed, too much interest may be responsible for the exhausted condition. In such cases, a prescription for the normal amount of rest in bed at night, or the addition to this of one or two hours, with the proper utilization of the Saturday half-holiday and Sunday for an additional rest of one or two hours at mid-day, regulation of a sufficient quantity of out-of-door exercise and overfeeding if the weight is below normal, will often give good results. Individuals of a nervous temperament will often have to be trained to control their own work; to work at lower tension and to recognize that fussing and worry do not accomplish a surplussage of work. It will often be necessary, in order to understand the case, to watch such individuals at work and to teach them how to accomplish their ends by a systematic procedure and the proper relative attention to be paid to important and trivial matters.

Men of responsibility must be taught that the nervous system will not stand the same amount of wear and tear at fifty-five that it would at thirty, and that a nervous breakdown at the former age is of much more serious consequence, so far as aging the individual and incapacitating him for hard work, than a breakdown in early life. There are, indeed, certain individuals of intensely nervous temperament who are bound to have a nervous breakdown sooner or later, from their method of working. The earlier in life it occurs, the sooner will the lesson be taught that the nervous system has its limitations and that certain laws of nature must be respected. The "intellectual debauch," a form of dissipation seen in brain-workers and those of artistic temperament, indulged in too frequently, has as serious consequences on the nervous system, both physically and functionally, as the alcoholic or the sexual debauch. In such individuals, if taken early, a period of rest from work, two or three months of camp-life in the woods, a like period of foreign travel, with regular hours of rest, meals, and exercise, will be sufficient. It is quite important in these cases that a definite régime should be outlined for them, and if the patient is sent to a foreign land, that a definite itinerary be outlined, in order that too much sight-seeing *à la Baedaecker* may be avoided. These individuals, if left to themselves, return from Europe having seen everything that is worth seeing, and much that is not,

thoroughly exhausted, and thoroughly disgusted with the idea of facing a winter's work in an unfit condition.

It is often advisable to place these cases under a modified type of rest treatment; this will vary with the individual case and the exigencies of the occasion. In one case the individual will be permitted to work until mid-day and then ordered to rest for from one to two hours after luncheon, and spend the rest of the afternoon at golf or tennis or other congenial exercise, to be followed by a hot bath, a cold shower, a half-hour's rest before dinner, retiring at a definite time early in the evening. In still other cases it will be necessary to remove the individual entirely from his occupation and to enforce a fairly full scheme of rest, without, however, approaching the rest treatment.

Partial Rest Treatment.—Here, as in the full rest treatment, a full schedule is outlined, under which the individual is kept occupied with a minimal waste of energy. The schedule will vary somewhat in every case. The patient should remain in bed in the morning until eight-thirty or nine o'clock, should have the morning bath at nine or nine-thirty, breakfast at nine-thirty or ten, or have breakfast at an earlier hour in bed if necessary, a period of massage or mechanical therapy or out-of-door exercise at eleven, a period of rest or reading from twelve to one, mid-day meal at one or one-thirty, a period of from one to two hours rest in bed from one-thirty to three or four, afternoon exercise, a visit to or from the physician, a short period of rest before dinner, an hour of congenial association after dinner, the patient retiring at eight-thirty or nine. This treatment may be carried out at home or at hospital, or combined with a change of environment, at the sea-shore or in the mountains. The exercise and recreation should be prescribed and the components increased or decreased with the same care as in the administration of a drug prescription. A few cases require the full rest treatment as prescribed by Mitchell.

Full Rest Treatment.—When the exhaustion has reached an extreme grade, the nervous irritability marked and associated with emotional outbreaks, and the will-control is markedly reduced, or when extreme weakness is associated with low nutrition, full rest treatment is indicated. While under full rest treatment the patient is fully confined to bed. This entails such a protracted convalescence that it has been my own policy to insist on this only when it cannot be avoided. A period of from one-half to one hour out of bed each day will aid materially in the restoration to normal exercise and activity after the rest treatment is concluded. Getting the patient out of bed and back to normal action is one of the most difficult and tedious problems in connection with nervous disorders. As Mitchell well states, it is easier to get these patients in bed than out of it. The theory of rest treatment is to secure the maximum of rest for the nervous system with the least possible expenditure of energy, the least discomfort and worry to the patient, and at the same time to prevent an ingrowth of consciousness—hypochondriasis and introspection. The problems presented in the carrying out of this treatment are to keep the muscles, the gastro-intestinal tract, and the other viscera

in normal condition, and to fix the patient's attention on externals, in order to prevent introspection and ennui. Almost invariably the patient and the patient's friends state that they could not bear to be locked up in a room in their nervous condition, or that they will surely go mad. As a matter of fact, when the rest treatment is properly conducted they are too busy to go mad or to do anything else except to follow it.

The patient should be removed from home to a rest-house where there are few patients and where the management is trained to the handling of nervous cases. A hospital conducted on the same principle answers the same purpose when the question of expense excludes a rest-house. A hospital of hustle and bustle and surgical worry is not adapted to these cases. Good nursing and constant attention in the general medical wards of a general hospital may suffice when the question of economy demands it. Absolute seclusion must obtain. The patient should have no visitors, no letters, no communication with the outside world, and should be assured that anything of importance in connection with his family which he ought to know will immediately be communicated to him by the physician. Inasmuch as the treatment is to a large extent a fight against time, the selection of the nurse becomes of great importance. The success, indeed, of the handling of nervous cases depends upon the wisdom and judgment of the physician, in his selection of a competent nurse, and the person who gives massage. Inasmuch as the nurse must be the constant and practically the sole companion of the patient for a series of weeks, it is highly important that she should be acceptable to the patient. She must be a girl of refinement, trained to the handling of rest cases, and have sufficient brains to adapt herself to the changing conditions and moods of the patient and to control them. It is important that the nurse be loyal to the physician and have confidence in his ability. It is important because a patient will soon detect any lack of confidence or friction, and absorb it to her own detriment.

If the nurse does not prove acceptable to the patient, she should be immediately removed; this does not mean that the nurse is incompetent, but that she does not happen to fit in this particular case. In prolonged cases it is often advisable to change the nurse at regular intervals if competent nurses can be secured. In cases in which the enforcement of strict measures will in all probability bring friction between patient and nurse, it is often advisable to hold the selected nurse in the case in reserve, while another and perhaps less competent nurse enforces the regulation and receives the ill-will of the patient. This much can be definitely and positively stated, that rest treatment carried out at home, with the nurse a friend of the family, is bound to fail. The patient must be removed from home, and the nurse selected for her ability and her particular qualifications as adapted for the case to be nursed. Having selected a nurse and a place for treatment, the treatment is begun by establishing in severe cases complete isolation, and in the milder cases a relative isolation.

Isolation is one of the most important elements in the treatment. It relieves the patient from worry about the important and often unimpor-

tant details of life, and the necessity of strain incidental upon an attitude of friendship and a pleasant bearing toward irritating personalities. The physician should always insist upon knowing the tenor of the home life of the patient, and how much of the exhaustion is due to family friction, financial worry, hidden skeletons, etc. During the course of treatment many of these factors can be corrected by teaching the patient a philosophical attitude toward them. Having isolated the patient, the routine for the day should be regulated and written out for the use of the nurse. Directions and measures should always be a matter of written record. Nothing so often produces lack of confidence in the physician and nurse than a slovenly attitude toward treatment and a lack of appreciation of the importance of details.

At first *the diet* should be limited to milk in small quantities, from three to six ounces, depending on the case, every three hours. Just as soon as possible this should be increased until the patient is taking eight ounces of milk and one raw egg at the same intervals. As soon as the patient is able to stand the forced feeding, it has been my custom to apply the diet used in tuberculosis. Three glasses of milk and two eggs are given at 7 A.M.; two glasses of milk and one raw egg at 9.30 A.M.; a full meal, consisting of soup, a hot roast of beef, lamb, fowl, etc., two vegetables, pulled or thoroughly toasted bread and butter, and a simple desert at 1 P.M.; two glasses of milk and one egg at 4 P.M.; three glasses of milk and two eggs at 7 P.M.; and two glasses of milk at 9.30 P.M. I have never yet seen a patient, either tuberculous or neurasthenic, who was not able to handle this diet if administered properly. The nurse should see to it that the patient finishes the milk within a period limited to ten minutes. A necessary part of this overfeeding treatment is the administration of a hydragogue purgative, as Epsom salt, at least once a week, whether the patient needs it or not. As the desired weight is secured, the milk is gradually reduced and three full meals substituted. If necessary, a glass of milk with one raw egg may be added after each meal or at bedtime, or midway between meals. In some cases the increase in weight can be secured by less nutrition. Ten glasses of milk, or even eight will often be sufficient. In anemic patients raw beef sandwiches may be used in place of milk in the diet.

Massage is the next most important element of treatment. It is absolutely essential in order to keep the digestion in good condition, and to convert flabby muscular tissue into that of good consistence, ready for the work to be thrown upon it during convalescence. When properly given, it exercises the patient without unnecessary expenditure of energy. In some cases it produces fatigue, and here should be limited in its employment to a period within the fatigue point. I usually prescribe the massage in the morning, but may transfer it to an evening hour if it has a somnifacient effect in patients with insomnia. In some cases the massage has a reverse effect of producing decided irritation and excitement. A tactful operator can easily overcome the personal objection to massage upon which much of the irritation exists, by first limiting themselves to a perfunctory rubbing, adding some suggestion, and gradually increasing

up to the normal treatment. A skilful, tactful operator has a decided, beneficial influence, properly using suggestion in connection with the treatment. A gossipy masseuse or one with a mission may often do harm. It is, therefore, important that the physician should have personal knowledge of the operator, and that he should occasionally be present during treatment, in order to watch the method employed, and to note the character of the conversation and its effect upon the patient. In the average case the massage is ordered for a period of thirty minutes, and this is gradually increased to a full hour. In the less severe cases, Swedish movements may be added from the beginning, and in the more severe cases, during convalescence.

Electricity.—Electricity, like massage, has a twofold value. It keeps the muscles in good tone, and so regulates the metabolism and takes up the greater portion of an hour during its administration. It is a valuable means of carrying waking suggestion to the patient for the relief of local symptoms. If massage is given in the morning, electricity should be given in the afternoon, or if electricity is given in the morning, massage should be given in the afternoon. If faradism is the form of electricity used, it should be applied by a nurse who should be trained in its application. The current should be so regulated as to cause contractions of the muscles when the two electrodes are placed over the muscles. The slowly interrupted current is preferable to the rapidly interrupted current. The muscles of the entire body should be treated, each muscle being made to contract from four to six times. From forty minutes to an hour should be consumed in the treatment. Some patients have an unreasonable fear of electricity in general, while others object only to the rapidly interrupted current. In these cases galvanism should be used, or if too much irritation is produced, the electricity should be eliminated from the treatment entirely.

Psychic Treatment.—Any form of treatment in functional nervous disorders which does not take into consideration the psychological constitution of the individual is bound to be a relative failure. It is not at all easy to place on paper such a complicated matter as the method of influencing the mental constitution of a nervous patient. Therapeutics, after all, is more an art than a science. In nervous diseases this is particularly true, and the apprentice must serve his time in the footsteps of the master. There are, however, some well-recognized elements of the treatment. The most important of these is:

- A. Suggestion; the next in importance is:
- B. Reëducation; of equal importance is:
- C. Retraining in the will-control; and of least unquestionable importance is:
- D. Psychic analysis.

Suggestion.—Suggestion may be of two kinds—waking suggestion and suggestion in the hypnotic state. A patient suffering from functional nervous disorders will absorb an atmosphere of confidence both on the part of the physician and the nurse; for that reason the physician who treats neurasthenia successfully should be absolutely sure of his ground

and of himself, and to this should be added a positive personality, with, however, a full appreciation of the actual suffering of the patient and proper sympathy for it. As Osler well puts it, in speaking of the therapy of tuberculosis, "A physician should have a large heart and two large thumbs." A large heart for sympathy with the patient in his or her trouble, and large thumbs to enforce the treatment necessary, be it ever so severe. This does not imply, however, that the sympathy should be too evident either on the part of the physician or the nurse, or, on the other hand, that it should be withheld. A proper admixture of periods of severity alternating with a milder attitude often gives the best results. Above all things, the physician must gain and retain the confidence of the patient in his ability to cure him. He must be certain of every step taken and avoid, more particularly in the application of suggestion, any trick of treatment of the success of which he is not reasonably certain. The whole atmosphere should be one of encouragement. As to the application of waking suggestion, that must depend upon the symptoms and the condition of the patient. Take, for example, the subject of insomnia. This symptom may be a matter of habit on the part of the patient and may be controlled by a tactful nurse, by gentle massage or simple stroking of the head, with the suggestion that it will produce sleep. In other cases, trional may be given in addition to the above procedures for the first two or three nights, and then may be omitted. More frequently the dose is reduced, the same capsules being used, and after two or three nights cornstarch is administered instead of trional. The pain in the back may be removed by similar measures; the application of galvanism, with the suggestion that it will relieve a functional neuralgic pain, will often be successful.

If from his judgment of the case the physician expects a definite improvement in various directions, an indirect suggestion in the form of a positive suggestion to that effect to the nurse, that the patient need not be expected to hear, will often be of material aid in securing the desired result. In neurasthenia every effect produced by *hypnotism* may be secured by making suggestion. Years of experience in the use of hypnotism leads me to the conclusion that in neurasthenia it can do no good and can only do harm. When a physician is forced to the use of hypnotism, he has failed in the handling of his case. If used repeatedly, it reduces the will-power of the patient and is likely to lead to a marked lack of control. Religious suggestion, or rather enforcement of suggestion by the use of the patient's religious belief, may sometimes be of value, but often entails such play on the emotions as too often to lead to harmful results in advanced neurasthenics; in the milder forms, "miracles" often result. If the physician, however, who has previously treated the case has used sane methods of treatment, he too might have performed the miracle, for which, however, he might expect no great credit. The physician, as a rule, can have more influence in regulating the troubles of the soul of the individual than can the clergyman, if he will only take the trouble to know his patient and use the proper measures when the patient is prepared for them, and the nervous system properly balanced.

The physician who does not know all the elements of worry tending to the nervous breakdown will not be able properly to treat his case. A New England conscience is a prolific cause of nerve waste. In a recent case that had resisted treatment at the hands of another physician, the trouble was due to the inability of the physician to appreciate the constant worry in a girl of high nervous tension for whom a single moral lapse constituted an unforgivable sin and left nothing for the future but a self-imposed disgrace. To readjust the moral atmosphere of such a case was indeed a task. The means employed would need a small volume for their elucidation. In such a case the physician becomes the confessor and the consoler; and the clergyman, with his rigid ideas of morality and essentially narrow perspective if he be a good clergyman, could do nothing but harm.

Reéducation.—The proper use of reéducation carries with it much suggestion. By reéducation is meant, in a broad sense, the explanation to the patient by the physician, who has attained his or her confidence, the principles upon which functional nervous disorders rest, and their application to the particular case under treatment. The reestablishment of confidence by the assurance that the condition is not of a serious nature and what may be expected in the nature of cure from simple methods of treatment acts as a direct suggestion. In some cases of neurasthenia, more particularly those in which the intelligence is of a sufficiently high order to appreciate the physical and psychological analysis of their own case, this method may have much value. Not only may the general principles on which the treatment is based be explained to the patient, but the technique, so to speak, may be from time to time explained, here again carrying as much suggestion as thought advisable. Indeed, intelligent patients often know too much concerning methods of treatment of functional disorders for their own good.

Lectures on psychotherapy and books on home help for the nervous individual too often reach those of a deviate turn of mind, who can neither appreciate nor apply, and usually misapply, the information contained in them. The individual of nervous temperament, with a tendency to exhaustion, needs, as a rule, education on how to live properly. This must, however, be applied to the particular case by one who understands the nature of the nervous individual, and is able to direct without concentrating too much of the attention, and thus producing introspection, which is to be avoided. The statement of James concerning reserve layers of energy which may be pushed through and used up for purposes of work is true as to the normal individual. Harm has been done to nervous patients by trying to apply these principles. What James did not teach, and what must be appreciated even by the normal individual, is that the reserve layers of potential energy were intended by nature for emergency purposes and not for every-day use. The normal individual may draw on them to a large extent over a long period of time, but even he must pay the price sooner or later by deficient nervous force and vitality. The individual born with a deficient nervous system, or one who has exhausted the normal nervous system, has little if any reserve nervous

energy to draw upon, and too great an expenditure leads to serious consequences. Reëducation would in many instances not be necessary if the nervous system were properly disciplined in the primary education in childhood, and if the nervous child were taught that years of illness could be saved by an appreciation of their own limitations. It would appear from Dubois that all the functional neuroses can be permanently cured by a simple process of reëducation. Certainly, we do not understand neurasthenia as he does. A woman suffering from nervous exhaustion, and who is confined to bed for two months, can certainly not be placed on her feet and made to walk a distance of half a mile without a serious relapse.

The Training of the Will.—A much more important element, to my mind, in the treatment of neurasthenia and psychasthenia is the treatment of the will and willing power of the individual. This does not mean so much the conscious determination of the individual to do a certain thing as what might be termed the subconscious or automatic control, not only in reference to external activity, but also to internal activity. This method of treatment has perhaps a much wider application in the lack of control seen in hysteria than in neurasthenia, but even in neurasthenia it is a very valuable method of enforcing the vigor of the nervous system. It may be stated as an axiom that the will-power of the individual in reference to external activity, or even in reference to their own persons, cannot be increased by conscious personal effort. The most that one may do at a given time represents the maximum of the will-power; this may, however, be materially increased from without by one with proper authority enforcing certain penalties or holding out certain rewards. Let us take, for instance, the simple matter of nervous vomiting, or, what is more common, the inability to take a full diet as prescribed. A combination of suggestion with will-power reinforcement is used. A physician in apparent sympathy with the patient states to the nurse: "You will have to rest up the stomach for a few days, in order that the patient may take a full milk diet;" a teaspoonful of milk every three hours, with absolutely no other food or liquid, is then ordered. The patient may go for a long time without food, but an all-consuming thirst at the end of twenty-four to forty-eight hours enables the patient, who has honestly tried to control the vomiting previously, now to take a full milk diet. A recurrence of this symptom would mean even a more prolonged period of abstinence. The memory of this harsh measure and the fear of its reëmployment gives to the subconscious control of the stomach a reinforcement which places it upon a normal basis. Here we morally spank the stomach as we would spank an undisciplined child. Thus, a case of recurrent photophobia was treated by a limited diet, confinement in a dark room, and visitors eliminated for a period of from two to three weeks each time it occurred. This course of procedure was extremely disagreeable, and after three periods of its application no further recurrence occurred. In a recent case at the Philadelphia General Hospital, a persistent attack of nervous hiccup had resisted all methods of treatment until the scalp was progressively shaved

from the nape of the neck up, every three days, and a blister applied each time. This young woman, of attractive appearance and with a fine head of hair, had sufficient time to consider what her appearance would be like when her hair would be completely removed, and by the time the vertex was reached the hiccough entirely disappeared. This treatment, of course, carried with it the suggestion made to the resident physician as to how deforming the loss of hair would prove, and how in all probability it would not be necessary to disturb more than the posterior half of the scalp. These may be considered as extreme measures, but the desire of a homesick girl to see a beloved relative, a mother to see her child, or a wife to see her husband, may be used in the same way. The satisfaction of minor matters of desire is used for minor symptoms; greater and more intense longings being satisfied only with the disappearance of the most resistant manifestations.

The question has been asked of me by other neurologists as to how the reinforcement acts when the individual returns home free from the influence of the dictator. It should be borne in mind that with an increase in the physical and the nervous vigor there is a tendency for a readjustment of all the fatigued derangements and manifestations to normal.

If some special part of the nervous system has been deranged in its function over a long period of time a habit of perversion is established which may persist "as an accident" after the nervous system has returned to the normal. It is in such cases that hypnotic suggestion performs its greatest miracles. These symptoms, however, should be eliminated while the patient is under treatment. A desire to avoid a repetition of the rigorous methods employed has a beneficial effect after the patient has left the care of the physician. It should be the policy of any well-conducted course of treatment to test out the condition of the nervous system by keeping the patients under observation until they are able to stand the wear and tear of normal life.

Psychic Analysis.—*The "Psycho-analysis" of Freud.*—The "psycho-analysis" method for treatment of nervous diseases was introduced by Freud. It rests upon the theory of stress upon the nervous system as the result of subconsciously repressed memories in the neuro-sexual sphere. The method of treatment carries much suggestion with it. An effort is made in repeated sésances to resurrect the subconscious memories; when all of these are eliminated, the nervous system takes a bound to normal activity. In a few of the sexual cases of neurasthenia, in that group of hysteria resting on an unmoral basis, this method of treatment if properly handled may be of value. My own attitude, and I think I may properly say that of American neurologists in general, with one or two exceptions, is adverse to its employment. The sexual neurasthenia develops, as a rule, upon a deviate type of nervous system. There is a small group of cases where worry about sexual matters rather than the sexual abuse itself (the sexual abuse having been abandoned) is due to introspection as the result of vicious literature. These cases, as a rule, react to simple measures. These, as well as the more complex

sexual group, need reëducation and explanation together with proper work rather than rest.

Convalescence.—The patient on the rest treatment will have sufficient to keep the mind employed the entire day. The schedule will depend upon the patient and will vary according to the time to be consumed. Treating a large number of cases by a definite set rule will lead to more harm than good. The greatest care must be used in getting the patient out of bed and back to work. Here the rule must be that all forms of physical and mental activity must be prescribed in quantities well within the patient's power to carry them out without fatigue, and gradually increased in small increments. The patient should be allowed to sit up in bed and the time gradually increased to an hour. He should next be permitted to sit in a chair and then to walk a short distance with a daily increase. The more complex forms of activity require careful study. In some cases the time may be taken up during convalescence with various types of purposive work. I am not a believer in occupation therapy as it is often employed, *i. e.*, an institution with four or five varied types of work, such as bookbinding, gardening, etc., to which all types of patients are adjusted. The work should be selected along purposive lines, after a careful psychological study, with a consideration of the natural bent of mind and interest of the individual. Where the patient already has an occupation, he may be replaced in it with limitations as to the character and quantity of work and the time to devote to it. If the patient has not learned in the course of the treatment sufficient about himself and the laws of health to keep well, the treatment may be considered to have been a failure, and a loss of time to both doctor and patient.

DISORDERS OF SLEEP.

Insomnia.—Insomnia must always be considered as a symptom, although it may in some cases dominate the clinical picture. It, therefore, should never be treated as a disease, but as the manifestation of some underlying condition which demands attention. In some cases the insomnia persists long after the causative agent has disappeared. It may itself act this way as a causative agent in the production of secondary disorders of the nervous system. It practically always produces a marked drain upon the vitality, and for this reason needs special consideration apart from the disease groups with which it is associated as a symptom. This association with organic disease leads to marked loss of nervous vitality and alters the prognosis of an otherwise favorable case. Apart from the nutrition of an individual, there is no one symptom which demands more careful attention than that of disturbed sleep. In many cases weeks of upbuilding may be as promptly lost by a period of intense insomnia. There is no one symptom or group of symptoms which equals this in its deteriorating influence on the mental and moral nature of the individual. Persistent incurable insomnia has not infrequently led to self-destruction.

From the standpoint of preventive medicine, much may be done by proper education in the prevention of disorders of sleep. The general tendency appears to be drifting toward a disregard of the natural law that daytime is the period for activity, and the night a period for sleep and recuperation. This is fostered by longer hours of night recreation, and the general tendency to prolong social functions until the early hours of the morning. It is not only the individual in "society," whose only function in life is one of social enjoyment, who gets along without sleep and takes pride in it, but young men who are compelled to work with the mind and nervous system throughout the day, who take the same attitude. Men with serious aims in life, and with high ambition, often take much credit to themselves for being able to work for long periods of time with relatively little sleep. In all such cases nature must be paid back in premature nervous decay, or in periods of mental or nervous deficiency with various disorders of the sleep function. The mistake is not infrequently made by brain-workers in the belief that their best work is accomplished in the early hours of the morning when the first sense of fatigue has passed. This represents what may be called the stimulation of fatigue and its toxins. It is, however, burning the candle at both ends, and cannot be kept up for long periods of time without damage.

Under neurasthenia it is stated that in such individuals, and more particularly those of nervous temperament, it is much better to get their nervous breakdown early while their powers of recuperation are good, because, as a rule, they will not listen until the symptoms of exhaustion actually develop. The boy at school and at college, and the woman at all times, should be taught that there is a demand on the part of nature for a definite quantity of sleep; exactly what this quantity is varies considerably in different individuals and in different occupations. It may be stated, as a general rule, that eight hours should be devoted to sleep in individuals engaged in active work. There are, however, those who demand nine hours and even more sleep to maintain a comfortable existence. I recognize that prolonged hours of sleep may be cultivated as a luxury, with the result of diminishing the mental and nervous activity of the individual, and may, therefore, be reduced to a normal basis with benefit. There are others who are able to do normal and even exceptional work with seven or even six hours of sleep and maintain a normal condition of health. The case must be studied with reference to the needs of the individual and the amount of nerve waste involved. The nervous system does its work more easily with a minimal amount of waste if a fair degree of regularity is observed. Irregular habits may, indeed, be an important causative factor in the production of disturbed sleep. In estimating the needs of the organism and in studying sleep as a symptom, the character of the sleep should be carefully inquired into. There are, indeed, those who sleep with one eye open. The sleep is so light that the slightest noise is perceived. The sleep, on the other hand, may be so deep as to withstand the most marked disturbance. A relatively deep sleep, however, may be less satisfactory if the mind is actively engaged in dream processes. There are those in whom the sleep periods are always

taken up with dream states. These, indeed, may be so intense and active that the ideas elaborated may be carried over into the waking state for a period and constitute what is called "oneiric" delirium. The ability to fall asleep and the ability to wake, even when the system has not been properly recuperated, is so often a matter of habit that simple resting reactions do not suffice. If an individual awakes fatigued and unrefreshed after a period of eight hours of apparent good, normal sleep, an investigation will show that the overwork during the day demands longer hours, or that some source of nervous waste, either from irritation of the nervous system or visceral disease, demands longer periods for recuperation. Abnormal reactions sometimes obtain; in some cases a beginning neurasthenia may be so traced which promptly disappears with proper hours of sleep. In other cases impulsive ideas, perversions of thought, mental depression, or functional disease of the nervous system, such as habit spasm or tics, develop. A tendency to sleep to excess, and more particularly when this interferes with the occupation of the individual, demands careful attention. It may indicate some serious visceral trouble, or be the precursor of mental trouble. Ordinarily the tendency to sleep within the limit of a normal demand should not be resisted through the use of stimulants, such as tea or coffee, which prevent normal sleep and often lead to serious results. There is the effect not only of the loss of sleep, but the excessive drain and abuse of a tired-out nervous system.

In occupations in which there is a period of nervous stress at certain times in the year and periods of more or less relaxation at other times, the former should be prepared for by additional time devoted to sleep, or by a period of mid-day rest. Brain-workers should, as a rule, increase the number of hours of sleep in the spring months after a period of winter activity.

The examination of a case of insomnia, like that of a case of neurasthenia and headache, is not complete without a thorough survey of the activity of practically every tissue in the body and a history which embraces the sphere of the entire mental life of the individual. The necessity for this becomes evident with an appreciation of insomnia as a symptom of various forms of visceral disease; as a reflex manifestation of disturbance of function of the special senses, more particularly that of sight; as a fatigue manifestation of neurasthenia and hysteria, and as an important early symptom of various forms of mental disease. We may, therefore, divide these cases into two groups—those dependent upon an organic basis and those dependent upon pure functional disturbance. In the organic group we have a definite basis for therapeutic activity. In the purely functional group the treatment becomes more complicated, because of the complex nature of the causative factors and of the functional perversion, not only of the brain, but of the viscera. In dealing more particularly with nervous individuals, little reliance may be placed upon the word of the patient. Not infrequently an observant nurse will show a report of from six to eight hours of normal sleep for several successive nights, with an equally positive statement from the

patient that they have slept not over an hour in any one night. A study should be made not only as to the hours of sleep, but also as to the depth of the sleep. The patient should not be aware that the sleep is an object of observation. The nurse should be trained to visit the patient at definite intervals, to note the breathing and whether the patient is sleeping. A whispered request should be made, and if this is not answered it should be later made in a louder voice. The closing of a door, the turning on of a light, may give some idea as to the depth of the sleeping process.

Having determined the actual degree of insomnia, the cause of the affection should be investigated by a history of the case. The history should include not only the history of the patient from childhood, but also the history of the disease in detail, the sexual life with its problems, the occupation, with all its details, including the place of business with its degree of ventilation, method of work, etc. The food and its ingestion should be investigated. The home atmosphere should always be a matter of careful scrutiny, as should the method of spending the evening and more particularly the activity preceding the hour of retiring. All sources of worry need careful consideration. The husband, wife, or business associates of the patient will not infrequently give the key to the solution of the case which has entirely escaped the patient. The physical examination should be as complete as the history. If the eyes have not been examined within a reasonable time or by competent authority, they should be reexamined. A nose and throat and ear examination is likewise necessary. A careful scrutiny of the teeth should never be neglected. I have seen persistent insomnia relieved by the removal of a filling which had not produced pain. The insomnia in this case began immediately after the teeth had been attended to, and the removal of the filling, against the advice of the dentist, gave immediate relief. The gastro-intestinal tract should receive careful attention. Poor digestion with or without abdominal distention is a frequent cause of disturbed sleep. Insomnia and other disorders of sleep occur with striking frequency in pulmonary tuberculosis; cerebral anemia due to low blood pressure with weakness and intoxication are the important etiological factors. Exceptionally high or low blood pressure may produce defective sleep.

Simple Insomnia.—In normally constituted individuals it is questionable whether such a condition as simple insomnia exists. The irregular habits of sleep already mentioned, in association with an oversensitive nervous system, may finally lead to disturbance of sleep without other evident causative factors. The enforcement of regular hours of retiring, assisted for the first few nights by some of the simple hypnotics, to be later considered, will suffice for restoring normal habits of sleep.

The Insomnia of the Functional Nervous Disorders.—*Neurasthenia.* Before taking these subjects up in detail it will be necessary to differentiate the insomnia of the different groups. The insomnia of nervous exhaustion usually follows a period of excessive demand for sleep which has been inhibited, or where the nerve-waste continues during the sleeping hours. If the mind of the neurasthenic is centred upon the question of lack of sleep, it dominates the entire mental atmosphere, accentuates the sleep

disturbance, and this in turn leads to further exhaustion. Inasmuch as these cases are usually hypersensitive to sound, this may lead to excessive wakefulness, with the loss of sleep in turn leading to the development of a hyperacusis. In some of these cases I have not been able, with concentrated attention, to detect sounds which the patient held responsible for the inability to sleep. These cases, however, need careful study on account of a tendency to unconsciously exaggerate quantitative loss of sleep. If it is discovered upon careful investigation that a reasonable degree of sleep is secured, the mind may be directed to other and less exhausting fields of introspection. Each patient should, in addition, be assured that even moderate deficiency of sleep will not militate against recovery; that when the patient is able to accept philosophically a relative diminution in the hours of sleep, and to remain quietly at rest instead of nervously threshing the bed in an effort to get sleep, the nervous system may be rested and proper recuperation obtained.

A perversion in the hours of sleep is not infrequently noted in this disease. Beginning with the period of insomnia at night, a habit of sleeping several hours of the day ensues, with bitter complaint of the long hours of wakefulness at night. While the mid-day nap may be advisable, too much sleep during the day usually results in disturbed sleep at night. This is, indeed, often the case in those confined to bed from any cause. The nurse should be ordered to see that the patient is kept awake during the day, with the usual result of the restoration of normal habits. The exhausted nervous system is sensitive to food reaction. The neurasthenic is not able to go for long periods of time without food. Insomnia is often relieved by the administration of a glass of milk or some toast or soda-biscuits at bedtime, or during wakeful periods during the night. The food should always be given with the suggestion of its value in producing sleep. In many of these cases proper nursing is essential. Preparations for sleep in a neurasthenic should be a matter of definite technique. The arrangement of the room, the preparation of the patient for the night, the re-arrangement of the bed, and the many details carrying with them suggestion should be gone about slowly and progressively without hustle or bustle or unnecessary discussion, with a short period of quiet, soothing conversation before the lights are turned out. There should be no conversation after this time. In some cases a short period of massage has a decidedly beneficial effect. A gentle head massage is often successful when general massage fails. Nervous indigestion with abdominal distention should be relieved by appropriate remedies. One rule in nursing in neurasthenia should never be neglected: the bowels should be evacuated daily; not infrequently the irritation due to constipation will prove deleterious.

In mild or moderate cases of neurasthenia a proper regulation of work and play, a certain period of the day spent in the open air with proper exercise, and the enforcement of regular habits will be sufficient. An ocean voyage, a few weeks in the woods, for the overtired professional or business man will often give the desired effect. In all such cases not only the patient, but as far as possible his companions for the trip, and

their habits should be studied before the rest is decided upon. The introspective, hypochondriacal type should not be sent alone into the woods. The convivial or habit individual should not be exposed to too much temptation at fashionable watering-places. Drugs should not be relied upon for the continuous production of sleep in neurasthenic patients.

When there is marked nervous irritability I have secured the best results by the proper use of the bromides. These should not be given in one large dose, but should be given properly disguised in smaller doses of 10 or 15 grains, three or four times throughout the day. If the drowsiness occurs too early, the medicine may be given at dinner-time or bedtime, or may be arranged for even later hours, say 4, 7, and 10 P.M. After a definite effect has been secured for several nights, the dose should be rapidly reduced. If this should not prove effectual, trional should be given in doses of 10 to 20 grains, from one-half to three-quarters of an hour before the sleeping time. Sulphonal may sometimes be effectual when trional fails. Veronal and medonal are less valuable hypnotics, on account of a tendency to drowsiness or even mental confusion the following day. Veronal may be combined with trional in 5 grain doses of each, and the veronal rapidly eliminated from the prescription. Chloral in doses of from 5 to 20 grains is sometimes of value in combination with the bromides, trional, or veronal. Hydrotherapy should be used in conjunction with other measures. This has been considered in full in Vol. I of this system.

Hysteria.—The treatment of the insomnia of hysteria should follow in the main that given for neurasthenia. These patients are much more amenable to suggestion, and often react to measures which fail in the simple cases of neurasthenia. If any actual cause of wakefulness is removed, almost any drug or measure, when applied with the proper suggestion, may give desirable results. Electricity has in this group of cases attained striking results. As ordinarily applied, the results may be considered for the most part as due to the mental impression produced. The static breeze is sometimes used with benefit, but the best results are secured with the galvanic current. The exact results to be secured are explained to the patient or indirectly to the nurse. The electrodes should be applied both to the forehead and to the eyes, with gentle stroking. One electrode may be applied to the neck and the other moved about the forehead and temples. A current from five to ten milliamperes is usually sufficient. This may be applied by a competent nurse, sometimes during the evening, preferably at bedtime. The time of treatment varies with the case, and may be extended to as long a period as thirty minutes.

Hypnotism.—Hypnotism can be successfully employed in practically all cases of hysteria, but is a real necessity in a very small number. It is sometimes necessary in the hysteria produced by sudden physical or emotional shock. In such rare cases it may succeed when other means fail or when the drugs needed are out of all proportion to the results to be attained. It may be necessary in cases where the long-continued use of hypnotics has led to a loss of confidence in their efficacy. It should not be used over long periods of time, and should be replaced by other

methods at the earliest possible moment. If drugs are necessary, they should be given in full dosage and the quantity rapidly reduced, with the replacement of the drug with some placebo. In the treatment of insomnia, as in the treatment of all other nervous disorders, the patient should never be permitted to know the drugs employed.

Psychasthenia.—The psychasthenic, the neurotic, the semi-insane, are all prone to disturbances of sleep. They differ from the neurasthenic in the almost delusional importance ascribed to this symptom. It may be the result of overwork or worry, or the symptomatic manifestations of a perversion of the nervous system of developmental origin. In this group of cases the patient should be trained to proper methods of living well within the nervous capacity. Their nervous system should be disciplined from early childhood to be within control. If the insomnia has developed into a horrible, unbearable disease, it should be assigned to its proper place in the clinical picture. It is often well in such cases to apparently neglect the disturbance of sleep and to magnify some minor disturbance to replace it in the domination of the sphere of consciousness. In the meantime the habits of life should be regulated; self-control taught, and occupation on a farm or some manual labor with a therapy of hope and confidence, and with good perspectives as to life, developed. Indeed, the personality of the physician, if he can but secure the full and implicit confidence of the patient, is the best hypnotic, if the patient can be seen frequently.

Insanity.—It is not infrequent to hear from patients that unless they can secure sleep they will go insane. This is only true in cases where the patient has already arrived at such a condition. It may, indeed, be the only objective symptom for some time in a well-developed case of mental disease. Two symptom groups are of value in arriving at a proper diagnosis. Failure of purpose in work, mental depression, with an inherited tendency to insanity should always excite suspicion. If detected early and corrected, a fully developed mental trouble may be avoided, or the attack lessened in intensity. In these cases hypnotics should be given in full doses and increased until results are obtained. Hyoscine is perhaps the best hypnotic for this purpose. It may be given in doses of $\frac{1}{100}$ to $\frac{1}{50}$ of a grain and increased until the physiological effects are obtained. Depressing drugs should not be administered. Trional may be given in large doses. In the depressive group of cases opium is sometimes justifiable. Opium and its derivatives should never be given in any other form of insomnia. After the insanity is fully developed, hypnotics should be given with extreme caution. They more frequently do harm than good. In the transient alcohol cases, paraldehyde in full doses gives the best results. Hyoscine is also of value.

Toxic Insomnia.—Insomnia may be the result of toxins from without, or of toxins the result of disease. Tea, coffee, strychnine, alcohol, lead, mercury, or bisulphide of carbon may all produce insomnia. Both morphine and cocaine in drug habitués may have the same effect. Alcohol or more frequently the combination of tobacco and alcohol are frequent causes of disturbed sleep. The insomnia may, indeed, be the early symp-

tom of an approaching *delirium tremens*. It is a prominent symptom throughout the course of this affection. In chronic alcoholism, and more particularly that due to the distilled and fermented liquors, insomnia is not infrequently a symptom without evidence of delirium. The insomnia of acute alcoholism should be treated by the withdrawal of excess of alcohol, and if safe, the entire withdrawal of it, rest, and the administration of bromides in full doses. Twenty or 30 grains of the bromide of soda may be combined with 10 drops of the tincture of nux vomica, three, four, or five times daily, depending on the urgency of the case. If the heart and kidneys are normal in action, chloral in 15 to 20 grain doses may be combined with the bromides. After the *delirium tremens* has fully developed, chloral may be given, but its action should be carefully watched. Paraldehyde may be given in doses of $\frac{1}{2}$ to a full fluidram, and in my experience has proved the best of the group. Trional, veronal, and sulphonal have in some cases given favorable results. If the tongue is dry and board-like, and if there is kidney insufficiency, little result may be expected until this is corrected. Stupor and coma are much graver complications than the insomnia. In critical cases, with irregular cardiac action, it may be advisable to disregard the insomnia in preference to depressing the heart by large doses of hypnotics. I have seen grave complications ensue from the excessive use of bromides in alcoholic cases admitted to both the Philadelphia General Hospital and St. Agnes' Hospital. A fairly well-defined clinical picture is presented in this group of cases. The patient presents a low, confused type of delirium, or rather a confused delusional state, which may persist for several weeks. There is a coarse intention tremor of the hands, with distinct slowing of the speech, tachycardia with irregularity of the cardiac action, insufficiency of kidney action, and clay-colored stools. I have noted this condition only in cases in which bromides were administered in large doses. A full liquid diet, the administration of the tincture, or infusion of digitalis in full dosage, careful nursing, and close observation and attention on the part of the physician are necessary to prevent a fatal outcome in these cases.

The *insomnia due to tobacco* is more in the nature of a disturbance of the sleep than an inability to get to sleep. It not infrequently causes wakefulness in the early morning hours. In men past middle life, with moderate to advanced arteriosclerosis, continued mental depression with insomnia may be the direct result of excessive use of tobacco. In these cases complete withdrawal of tobacco, the administration of tonics, such as strychnine, digitalis, etc., gives uniformly good results. For a short period of time, until the sleep is restored to its normal length and depth, a bottle of beer at bedtime will often be found beneficial. The excessive use of tobacco may produce insomnia directly by disturbance of the gastro-intestinal tract, or by the depressing effect upon the circulation. *Insomnia due to tea or coffee* is usually associated with other toxic effects upon the nervous system, such as nervous indigestion or actual neurasthenia. Insomnia may be the direct effect of tea and coffee when taken late in the day. In the treatment of all forms of insomnia

from whatever cause the use of tea, coffee, alcohol, and tobacco should be entirely eliminated during the period of treatment.

The insomnia of visceral disease has already been noted. In pneumonia, typhoid fever, influenza, and septic conditions insomnia requires careful treatment in order to prevent rapid exhaustion. In the early stages of typhoid good results are often obtained by relatively small doses of trional. If nervous irritability be present, this may be continued with the bromides. In the later stages of typhoid, opium or one of its preparations, codeine by preference, either alone or in conjunction with hyoscine, may give beneficial results. It is hardly necessary to call attention to the beneficial effects of hydrotherapy (Vol. I) in overcoming this complication.

In the early stages of pneumonia, trional, chloral, or Dover's powders will usually be sufficient. In the later stages, if insomnia be present, it is not infrequently due to a flagging heart and a weakened circulation. Hypnotics, as a rule, are dangerous at this period. Trional is the least objectional, but must be given with extreme caution, and its action controlled by proper cardiac stimulation. The insomnia of septic infections requires the control or elimination of the infectious process. When the insomnia is due to arthritic manifestations of streptococcal infections, it may be controlled by aspirin combined with trional or veronal. The insomnia of acute articular rheumatism is due to the pain, and is treated in the same way. The insomnia following pregnancy may be due either to septic infection, to nervous excitement, secondary anemia, or oncoming mental disease. In any event it should be very promptly controlled by the administration of full doses of bromide during the day, with trional and veronal in full dosage at night, and the exclusion of visitors for part of, or the entire day, from the sick-room.

Insomnia during convalescence from the acute infections may be the result of anemia, exhaustion, improper assimilation of food, or some visceral complications. This complication should always suggest a resurvey of the entire case, with careful examination of the excretions.

The frequency of disturbances in the gastro-intestinal tract as the cause of insomnia has been often referred to in this chapter. Whether this condition is due to actual disease of the stomach or intestines, to a simple functional derangement, or to intestinal auto-intoxication, the relief of it will depend on the ability of the physician to relieve the underlying conditions. Hypnotics, as a rule, are of little value unless the disturbance of the digestion can be regulated. Not infrequently the indigestion is associated with a coated tongue, injection of the mucous membrane, a flabby condition of the muscles, and torpid action of the liver and bowels. Whether we call this condition "lithemia," or label it as "torpid liver," "neurasthenic introspection," etc., it is a definite condition not infrequently met with in those of low nerve tone, with a tendency to "rheumatic" pains after exposure to cold. Regular and daily exercise, either outdoors or in a gymnasium, with an increased amount of rest, are more potent in clearing up the digestive disturbances than regulation of diet or the administration of digestants. Both tobacco and alcohol have a markedly deleterious

influence and should be promptly eliminated. Disease of the heart and of the circulatory system as a cause of insomnia has been frequently referred to. The kidneys should always be carefully studied. A word of caution should be recorded against the extensive use of bromides in the treatment of the insomnia of pulmonary tuberculosis. They not only disturb the digestion, but have a deleterious effect upon the already over-worked cardiorespiratory mechanism. The insomnia of early cases of tuberculosis undergoing a cure is in some cases the protest of the nervous system against too much and too long-continued adherence to a routine. A "vacation" of a week or two, during which the patient is permitted to do pretty much as he chooses within limits, will usually prove beneficial. The insomnia of organic brain disease has been considered elsewhere.

Excessive Somnolence.—*Narcolepsy.*—We have been dealing, up to the present time, with the difficulty in procuring sufficient sleep. The reverse condition of excessive sleep is often quite as puzzling, and requires as much care in the history and the examination for explanation and care. It is most frequently due to disease of the kidney. It may be the first symptom of an approaching uremia or diabetic coma. It may be an early symptom of tumor or abscess of the brain, or cerebral syphilis. It may be the result of an intoxication from the gastro-intestinal tract, or may be due to disease of the heart or liver. With an organic cause excluded, it may be the manifestation of simple obesity, hysteria, or epilepsy. Cases of hysterical narcolepsy will present on examination the evidence of hysteria. In epilepsy, the narcolepsy may be an equivalent for the epileptic attack, or it may be the only manifestation of an epileptic condition. When the condition lasts for days or even weeks, and in which the patient maintains a fairly rational existence, it is usually not of epileptic origin. These cases belong to the group of double or alternating personality, due either to hysteria, malingering, or the desire to please an overzealous psychoanalyst. All of these cases must be treated from a causative standpoint. Unless the case is properly diagnosticated and the cause determined, treatment is not of much value.

NEURALGIA.

The treatment of neuralgia when the condition is a functional disorder is practically the same wherever it is found. In recent years a close study of some forms of neuralgia have shown an organic basis. Such conditions should receive a different treatment, depending upon the pathological basis. Persistent pain limited to one nerve trunk over a long period of time should always lead to the suspicion of a low-grade neuritis. Purely functional disturbance in the distribution of a nerve may be so limited. In some cases localization of the pain in low nervous states is determined by minor sources of irritation.

Two essential factors must be considered in the treatment of this affection—the lowering of the general physical and nervous vigor, and certain toxic or local factors acting upon the particular nerve distribution.

Neuralgic pains associated with an exhausted or lowered nerve tone belong to the group of symptomatic disturbances usually designated as "hysterical" or "functional." The treatment of the neuralgias in this group is the same as that employed for neurasthenia and hysteria. These pains are like the sands in the hour-glass, disappearing in one area to reappear in another, until the physical and nervous tone is elevated above the symptom point. A painful condition localized to one area may remain as an accidental condition after the cause has been removed, *i. e.*, after the physical and nervous health has been restored. This may be due either to a pain habit, or to a slight local source of chronic irritation. It is, therefore, of special importance that the physician should know the condition of all the tissues before attempting the treatment of the local affection. All sources of local irritation should be carefully sought for and corrected. The course of the nerve, from the spinal origin to its distribution, should receive special attention. I have under my care at the present time a woman who was treated for hysteria and neuralgia during a period of two years, with a spinal tumor as the cause of the condition. Diseases of the spinal dura, and spinal caries, are sometimes overlooked as the cause of peripheral disturbances. I have seen a case of long-continued brachial neuralgia due to an aneurysm of the subclavian artery. When no such local condition is found, and if no organic disease of the nervous system, such as tabes or chronic meningitis, is discovered, a careful examination of the blood should be made for malaria, syphilis, or anemia, and the examination of the urine for the presence of sugar. Rheumatism and gout should always be considered as important factors in the production of neuralgic pains; they act most frequently in conjunction with exhausted conditions of the nervous system.

There are, therefore, three elements in the treatment of any case of neuralgia—the removal of the underlying cause, general elevation of the physical and nervous vigor, as described under neurasthenia, and the local treatment. The local treatment varies with the condition of the patient and the part affected. While it may be advisable to place the patient on a full rest, it is not advisable in cases of pure functional nerve pain to try for the rest of the part as indicated under neuritis. This has a tendency to concentrate the mind of the patient on the part, and is more likely to increase than to diminish the pain. Counterirritation over local parts of tenderness is often of value. This should always be used with strong suggestion, and this combined with the threats of its extensive use will add to its value. The application of the various forms of electricity will prove of benefit in proportion to the amount of suggestion they carry. They have, of course, a distinct beneficial effect apart from this. The selection of the particular form of current to be applied will depend upon the condition of the tissues, the nerve affected, and the patient. The static breeze is especially beneficial in neuralgic pains of the head and neck. The static spark and the high-frequency current are used in neuralgic conditions of the extremities and trunk. In nervous women, when these forms are not applicable on account of the excitement produced, the mild galvanic or faradic current may be applied. Light

therapy has been used with some success in the form of violet rays and the electric lamp.

In the resistant cases, operative procedures have been employed. Stretching of the nerve, acupuncture, the injection of cocaine and of distilled water have all been employed in the same manner as will later be described under Neuritis. Opiates should be used only with the greatest caution, on account of the tendency of many patients to contract the drug habit. It should also be borne in mind that the demand for opiates in the beginning of a drug habit may be manifested in the form of neuralgic pains. The drugs used for the treatment of neuralgia embrace every drug in the *Pharmacopœia* for the control of the pain, or as a nerve sedative. The drugs of most value are cannabis indica, gelsemium, acetanilid, phenacetin, the salicylates, and aspirin. It would be difficult in an article of this kind to state the exact dosage or administration of these various drugs. I employ them in the early part of the treatment, and feel that I have failed in diagnosticating or handling the case if there is a necessity for their continued use.

Trigeminal Neuralgia.—*Neuralgia of the Fifth Nerve; Tic Douloureux.*—All chronic painful conditions in the distribution of the fifth nerve have been grouped under the term trifacial neuralgia. Two distinct groups may be recognized:

- A. Those with an organic basis.
- B. Those of a purely functional nature.

The organic conditions most frequently found are :

- A. Tumor.
- B. Chronic degenerative neuritis.

Pain in the distribution of the fifth nerve may for a long time be the only symptom of a tumor, involving or pressing on the Gasserian ganglion. In cases of chronic pain in those of advanced years, with marked arteriosclerosis, the examination of the ganglion will show degenerative cell changes with chronic interstitial changes in the nerves. I have shown, in careful dissections of the fifth nerve, the intimate relation of the internal carotid to the Gasserian ganglion. In arteriosclerosis with hypertension, the distended and displaced internal carotid pulsates directly against the Gasserian ganglion. One or two small arteries are given off from this portion of the carotid. They may be obstructed either from sclerosis or by kinking caused by the change of position of the carotid itself. The intermittent pressure and the interference of the blood supply leads to the changes above described. Rarely in such cases the pain may be controlled by the reduction of the arterial tension. Most often these cases demand operation. Various operative procedures have been employed. These include section of one or all of the peripheral branches, the injection of alcohol into the nerves at their exit from the skull, section of the root of the fifth nerve between the ganglion and the brain, and complete removal of the ganglion. In cases with limitation of the pain to one branch of the nerve, local section or injection may give permanent relief. When all three branches are involved in this group, and when local treatment and medication have failed, complete removal of the

ganglion is the best procedure. This operation was at one time rarely performed on account of the difficulty in the technique. In the hands of careful surgeons it has lost much of its danger, and is now frequently employed. Cushing reports a series of twenty-three cases with one death. Schlösser advocates the injection of *alcohol*, by means of a dull cutting needle inserted in the foramen ovale, into the branches of the trigeminus *in situ* at their exit from the ganglion. This is a difficult procedure and requires extensive practice on the cadaver, and has not given conclusive results. In Schlösser's analysis of two hundred and nine cases, he found recurrence of the pain in an average of ten months in the majority of cases. This necessitated repeated injections. In Ostwalt's series relapses occurred in 30 per cent. within five months.

While these remarks refer to the organic group, they are equally applicable to cases of the first group which resist other methods of treatment. In early and middle life a larger group of cases can be referred to a rheumatic basis. The salicylates should be given in full dosage combined with small doses of the iodides. This may be combined with counter-irritation or, better, the use of electricity. For the control of the pain, gelsemium in full doses (beginning with 10 minims of the tincture and gradually increased), cannabis indica in doses of $\frac{1}{4}$ to $\frac{1}{2}$ grain of the freshly prepared drug, aspirin alone or in combination with phenacetin or quinine, often prove of value. Strychnine in ascending doses until the physiological limit is reached has not proved of much benefit in my hands. It has, however, been highly recommended.

Practically all forms of *electricity* have been tried in the resistant cases. The high-frequency current, the Laduc rapidly alternating current, the static breeze, are all highly recommended. I have, however, secured the best results from the galvanic current applied directly to the mucous membranes. This was first used by Vitek, who in neuralgia of the second and third divisions of the nerve applied, by means of a specially constructed electrode which he introduced into the mouth, a current of 1 to 1.5 milliampères to the infra-orbital nerve over the infra-orbital foramen and to the lingual and inferior dental nerves at the latter's entrance into the inferior dental canal, for five minutes. The entire mucous membrane of the affected side was then stroked, without, however, breaking the current. The pole used for application to the mucous membrane was the anode. Cases of supra-orbital neuralgia were cured by the direct application of the anode to the neighborhood of the supra-orbital nerve, under the eyelid, over the conjunctiva. A current of 0.5 milliamperè for one minute was used.

While all forms of local irritation in the distribution of the fifth nerve should be carefully sought for and removed, the indiscriminate removal of sound teeth is an unnecessary and deforming procedure. I never consider the investigation of points of irritation in connection with the teeth as completed until an x-ray picture has been taken and analyzed by competent specialists. I have seen cases where the neuralgic condition depended upon the narrowing of the dental canal as revealed in the x-ray picture.

In young women, and more particularly those of a nervous temperament, neuralgia of the fifth nerve should always be looked upon as of a purely functional nature. Marked hyperesthesia of the skin is not infrequently present in these cases. In the absence of reflex irritation these cases can usually be easily controlled by strong waking or hypnotic suggestion. A young woman under my care at the present time suffered from a most intense trifacial neuralgia for months. This was caused by a severe injury to the head and face on the affected side, by a fall from a stairway aboard ship. There was marked hyperesthesia over the supra-orbital and infra-orbital branches of the nerves. The exit points of the nerve were extremely tender. Operation for the removal of the Gasserian ganglion had been considered. Strong suggestion carried with the application of the galvanic current caused a complete removal of pain for three days at the first sitting. Since that time two further treatments are all that have been necessary for an apparently complete cure of the pain. I am strongly opposed to all operative procedures for trifacial neuralgia in patients under thirty years of age. It must be a rare case in which degenerative changes of sufficient extent as to necessitate so severe and dangerous an operation have developed so early in life. Morris Booth Miller has reported to me personally a case identical with the above, in which, however, there was no history of injury.

Cervico-occipital Neuralgia.—This form of neuralgia often depends upon rheumatic deposits in the tendons attached to the base of the skull. These cases yield to antirheumatic treatment combined with proper massage for the dissipation of the deposits. Pains in this distribution are frequently noted in neurasthenia and hysteria. Cervical caries, rheumatoid arthritis, spinal tumors, and hypertrophic cervical pachymeningitis all produce painful conditions in this area, and need only be mentioned.

Brachial Neuralgias.—Brachial neuralgias, as already mentioned, are extremely resistant to treatment; if neuritis can be excluded, the treatment does not differ from that detailed under neuralgias in general. Occupation pain, a form of *occupation neurosis*, may be considered under this heading. All occupations in which the finer movements are frequently repeated, have their special occupation neuroses. The so-called writer's cramp is the most frequently expressed type of this condition. Typewriters, piano-players, violin-players, clothes-pressers, baseball players, cigar-rollers, and sewing-women frequently present this condition. A rare form is seen in men who are employed for long periods of time in milking cows on large dairy farms. The occupation neurosis may manifest itself as a spasm either with or without pain, tremor, or neuralgia. In the treatment of the occupation neurosis it is well to bear in mind that some toxic condition may underlie. The most frequent of these is a lithemic or rheumatic condition. Anemia, alcohol, diabetes, lead poisoning, tobacco poisoning and the toxins of tuberculosis have all been reported as causative factors.

In the treatment of the neurosis the patient should be thoroughly rested, any underlying toxic factor removed, alcohol and tobacco inter-

dicted, and the occupation changed to one in which the movements of the members are dispensed with or are changed into those of a grosser character. If possible, the patient should devote at least four to six weeks to active treatment. The occupation should be given up, the patient placed under a moderate rest treatment, massage and Swedish movements with hydrotherapy, and electricity ordered either in the form of a faradic, galvanic, sinusoidal, or static currents. In many cases the patient will not be able to give up the work or take such a lengthy course of treatment. Under such circumstances it is possible to effect some slight change in occupation in the same business concern. Gymnastics, electrotherapy, hydrotherapy, and massage can be attempted outside of working hours. I have seen cases where an antirheumatic régime has cleared up a case in a relatively short period of time. I have seen other cases where an increase of two hours' rest in bed at night, with the elimination of coffee and tobacco, outdoor exercise for one-half hour twice a day, has cleared up the case while the patient continued at his occupation.

Intercostal Neuralgia.—This form of neuralgia must be differentiated from intercostal neuritis. Caries of the vertebræ, chronic meningitis, diseases of the pleura, aneurysm, and visceral condition must be eliminated before the diagnosis of pure neuralgia can be made. Counterirritation by means of blisters or the actual cautery offer the best hope of relief. The general measures already outlined need only be mentioned.

Lumbosacral Plexus Neuralgias.—The following forms of neuralgias have been described in this distribution: Lumbo-abdominal, affecting the lower half of the trunk and the legs.

Sciatic Neuralgia.—Pain in the distribution of the sciatic nerve is considered under Neuritis. It is extremely difficult to decide in a given case whether we are dealing with a low-grade neuritis, or a purely functional disturbance. The loss of the Achilles jerk is indicative of an organic change somewhere in the course of the nerve.

Femoral Neuralgia.—Femoral neuralgia affecting the anterior and exterior surfaces of the thighs; a special form of this, meralgia paresthetica, will be considered later.

Crural Neuralgia.—Crural neuralgia affects the anterior and upper portion of the inner side of the thigh as far as the knee. A condition somewhat similar to this, but probably dependent upon a low-grade neuritis, is sometimes seen as a sequel of thrombosis of the femoral vein.

Obturator Neuralgia.—Obturator neuralgia; this affects the inner side of the thigh, and is often associated with inguinal and femoral hernia.

Pudendal Neuralgia.—Pudendal neuralgia is an obstinate and extremely distressing affection. Pain and paresthesia, often of an unbearable nature, affect the internal and external genitalia, the rectum, and the bladder.

Coccygodynia.—This condition is of common occurrence in traumatic cases with a local aspect. It is sometimes seen in hysteria, and, like other forms of neuralgia, may have a rheumatic or toxic basis. The treatment of these various neuralgias does not differ from that already outlined; operative procedures are rarely justified. In pudendal neuralgias

resection of the pudendal plexus, a difficult and bloody operation, has been tried after other means have failed; it ought not to be recommended except as a last resort, and then only after a careful consideration of all the factors involved. A prolonged rest treatment combined with other measures will often prove efficacious.

EPILEPSY.

The epileptic convulsion may be considered as the symptomatic manifestation of some underlying intoxication, reflex or sympathetic irritation or nerve waste, or visceral disease, acting upon a finely balanced or unstable nervous system. I have already considered, under the etiology of headache, the factors which determine the epileptic convulsion in an individual with an unstable mechanism. It should be remembered, however, that the convulsion is not the disease. The confirmed epileptic presents a mental atmosphere and a nervous reaction sufficiently typical to almost make the diagnosis without the convulsion. This has a distinct bearing on the question of the care of epilepsy. Here we should clearly differentiate between curable and incurable cases, and in the incurable cases, between those in which we can control the convulsions and those in which we cannot. The curable case of epilepsy is one in which a convulsive tendency has its origin in a high-strung, sensitive, hyper-irritable nervous system, and where the convulsions, separated from each other by long intervals, are started by some definite exciting cause capable of demonstration. Even these cases may finally become incurable by repetition of the convulsions at sufficiently close intervals as to constitute a convulsive habit of the nervous system on the one hand, and to affect the mentality on the other. The treatment of every case of epilepsy must be considered in the nature of an experiment as to the final results.

To most people, the patient and more particularly the friends of the patient, the convulsion is the calamity, and if this can only be brought under control, the other features in the case will sink into insignificance. In other cases, the ambition to be as other men who have a purpose and ambition in life to do the world's work brings the question of curability to a distinct issue. While, therefore, in the long run, the treatment of the curable and the incurable cases resolves itself into the same problem, the question of the education and the determination of the life-work of the individual in the two cases is clearly distinct.

In order to treat epilepsy with any degree of success, a careful history and even a more careful examination is necessary. This admonition has been so often made during the course of a consideration of the therapy of the nervous system that it is becoming tiresome even to myself. I insist upon it for the reason that it is an exceptional rarity to have a case submitted for consultation or examination in which even the rudiments of a scientific study of the case has been complied with.

Once and for all it must be clearly understood that the bromides will not cure epilepsy. The most that can be said in their favor is that they

will sometimes control the number of the convulsions, but more often they will not even do this. I do not mean to imply by this that they are of no value, for I, indeed, consider them the most valuable drug aid to the treatment at our disposal. I do mean that in the treatment of epilepsy every possible source of reflex irritation, every latent or active visceral disease or auto-intoxication, all possible sources of injury to the brain or nervous system, every vicious element in the life of the individual which varies in the slightest from the law of right and natural living, should be carefully sought for and eliminated or corrected. The case is not ready for even preliminary treatment until the patient has passed through the hands of the specialist on the eye, the ear, the nose, and throat, the gynecologist, and in addition a careful chemical analysis of the evacuation of the bowels and the kidneys has been made. While the Wassermann reaction is not necessary in all cases, the study of the case is not complete without it.

The further treatment of the case depends upon increasing the vigor of the nervous mechanism. This is to be accomplished in two ways. In those of physical undertone, the weight must be brought to the normal, the gastro-intestinal tract must be brought to full normal activity, and the other viscera maintained at a full normal function.

With every possible source of waste of nervous energy checked, a potential reserve must be secured. This is to be accomplished by an automatic activity of the nervous system, whereby the periods of stress of normal living are thrown upon the nervous system in such a way that it is prepared to meet them with a full efficiency. In other words, the external demands on the nervous system are so regulated that the body meets them with the same mechanical machine-like activity as the working of the internal viscera.

Every detail of the life of the individual must be prescribed. The hours of rest should be above the normal; more important than this, the patient must retire at the same time every night without exception; he must rise at the same time every morning; the bowels must be trained to movement after breakfast, and no day should pass without an evacuation of the bowel; if this is not secured normally, an enema should be employed. The morning exercise or the morning's work should be begun at the same time, should last the same number of hours, and should be of proportionately the same degree of intensity for each succeeding day. A period of mid-day rest of from one to two hours should be taken if possible, and this at the same time each day. The afternoon period of work or relaxation should follow the same rule. The evening's occupation should be approximately the same in a general way.

The meals should always be served on time, at the same time every day, and the food should preferably be served in courses on account of the tendency of epileptic patients to gulp their food. Most patients do best on meat-free diet. This is particularly true in cases of intestinal indigestion with increased fermentation and an excess of indican in the urine. If meat is permitted, the white meat of the fowl, bacon or ham properly cooked, should be given by preference. It is of equal impor-

tance that meat food should be properly masticated. On account of the fact that bacon contains an excess of salt, it should be used in moderation. While a salt-free diet has been much advocated of late, it has not, in my experience, proved entirely successful. It is carried out only with extreme difficulty. If bromides are used in full doses, symptoms of chronic bromism, or rather symptoms of lack of salt, present themselves. Landsteiner and also Ulrich have caused these symptoms to disappear under the administration of common salt. The latter physician observed the disappearance of ulcers due to bromism under the local application of a 10 per cent. salt solution.

All these regulations can best be carried out under the personal supervision of the physician, at least in the early part of the treatment. After proper rules of living are established, the same treatment can be carried out in the country, where the tension of life is less, preferably on a farm, or a farm colony.

The education and the occupation of the epileptic is a matter of the greatest importance. The parents should be taught that in the vast majority of cases it is a mistake to permit an advanced education in one who suffers from or is predisposed to epileptic attacks. If the education is pressed as far as the entrance to college, this should be considered the maximum safe limit. We should, indeed, be satisfied in most cases with a more elementary education progressing as far as, but not farther than, the grammar grades. This should be combined with mechanical training. By this is not meant, however, the manual training schools, which are usually of a high-school grade, but the more simple mechanical occupations which are exemplified in the trade schools. A simplified farm life is the ideal occupation for the epileptic. The more complex the occupation, the greater the strain thrown upon the nervous system. Any occupation in which there is danger to life and limb in the epileptic attack should be avoided. The epileptic should be discouraged from attempting any of the learned professions.

Any educational scheme which does not embrace the proper training in self-control or the restraint of the passions, with proper obedience to authority, must necessarily fail in giving good results in these afflicted individuals. One of the values of the above outlined régime for the life of the epileptic is the training along these lines. The confirmed epileptic should be discouraged from the idea of marriage. The danger lies not so much in the transmission of epilepsy, although this has to be considered, but more as to the possibility and, indeed, probability of an inheritance on the part of the children of a soil for the development of a grave hysteria, neurasthenia, insanity, drug habit, etc.

Medicinal Treatment.—I believe that more harm than good has been done by the indiscriminate use of the bromides in the treatment of epilepsy. This has led to such an element of skepticism on the part of some as to lead to their disuse in some institutions. They unquestionably have, however, a decided value in the control of convulsions. As stated before, the convulsion is not the disease, but in the reflex types of epilepsy and in those classed under the curable group the convulsion is

the most important element of the epileptic syndrome demanding treatment. If it is not controlled, we are compelled to treat the disease epilepsy, and not the isolated convulsion or convulsive tendency. The convulsions should be studied as to their time of occurrence, their occurrence with relation to periodicity, periods of stress upon the nervous system, their relation to the menstrual period, etc. In a case in which the epileptic attacks are separated at intervals of three or four weeks the bromides should be given in extra large dosage for several days to a week preceding the expected attacks, in order to control them. The dose should be reduced by a third or a half for the intervening period. In some cases the maximum dose will be from 10 to 15 grains, three or four times a day, whereas, in other cases, 20 or 30 grains or even larger doses may be necessary. In giving the larger doses, the physiological limit should be carefully looked for.

After the convulsions have been completely controlled for a period of three or four months, the bromide should be given only intermittently for a period of a week, every third or fourth week. At the end of six months it may be entirely dispensed with. If the attacks occur during the night, the bromides should be given at supper and bedtime. They should always be administered in large quantities of water. In order to overcome the depressant effect of the bromides, I sometimes add to the prescription tincture of *nux vomica*, in doses of from 5 to 10 drops. In some cases the addition of glycerin in dram doses to a prescription appears to add to the value of it. In other cases, one of the bromides may be prescribed with fluidram doses of valerinate of ammonia. When the bromides have a tendency to produce irritation of the stomach, they may be prescribed with a good essence of pepsin. In cases of organic cardiac disease, or in cases where the blood pressure is low, a good preparation of *digitalis* may be added. I have seen excellent results from this combination. The extract of thyroid gland in full dosage of from 2 to 5 grains, three times a day, should be given in combination with the bromides, in patients presenting a slow pulse, dryness of the skin, etc. In selected cases the bromides may be combined with chloral, with advantage. I have seen excellent results from a combination of the bromides with *adonis vernalis*.

The administration of Bulgarian lactic acid bacilli, either in a fermented milk, or in the dry tablet, in some patients apparently sensitizes the system to the effect of the bromides, so that the same effects are produced by a much smaller dose. The coal-tar products may be combined with the bromides with excellent results at times. *Acetanilid* may be given in doses of 5 grains, three or four times a day. Care should be taken lest too prolonged use lead to chronic poisoning. Much has been claimed for the use of horse-nettle, the nitrites, the iodides, *cannabis indica*, borax, and, more recently, antidiphtheritic serum, antirabic injections, and rattlesnake venom. They sometimes are of value in selected cases, and may be used to replace the bromides in an experimental way, if for any reason the use of the bromides are contraindicated.

Traumatic Epilepsy.—Two types of this may be considered. In one there is distinct injury to the brain, with evidences of depression of bone, etc.; in the other there is simple concussion. After a study of the case assisted by the *x*-rays, the case falls into one of these two categories. In the first group of cases, operation is indicated, even though there be no evidence of cerebral localization, and the convulsions are of a general nature. In the second group of cases, operation, as a rule, does no good. In this group, however, if there be persistent headaches which do not yield to treatment, the skull may be opened for the double purpose of relieving the headache and controlling the epileptic seizures. On the whole, little is to be expected from surgical operations on the head in cases of general epilepsy even if traumatic in origin.

In *Jacksonian epilepsy* from injury, tumor, abscess, etc., operation is indicated, sometimes with a completely successful result, but more often with only relative improvement. Jacksonian epilepsy due to arterial disease, or arteriosclerosis combined with a chronic contracted kidney, does not, as a rule, yield favorable results to operative procedures. In any event, if the brain be exposed in any of these cases, the physician should be present at the operation to act as a brake upon the surgeon and prevent mauling and handling, and investigating a brain that presents nothing abnormal to simple inspection. It is the rare surgeon who, having exposed the brain, is content to leave well enough alone and does not try to find some palpable cause to reward him for his work.

In the syphilitic group of epilepsies the treatment should follow the lines laid down for syphilis of the nervous system.

APOPLEXY.

Cerebral Hemorrhage.—The treatment of cerebral hemorrhage may be divided into prevention, the treatment of the apoplectic attack, and the treatment of the residual paralysis.

Extensive arterial disease associated with marked variations of the blood pressure, or periods of marked cardiac overaction, present the soil upon which cerebral hemorrhage develops. Cerebral thrombosis in middle to advanced life occurs upon the same pathological basis as that seen in hemorrhage.

Cerebral embolism may result from a thrombus formed in a case of advanced arteriosclerosis with valvular disease, or in a case of fresh acute endocarditis without arteriosclerosis. The prevention of cardiovascular disease is considered elsewhere. If extensive vascular disease is present, and more particularly when vertigo, headaches, rapid mental exhaustion, and temporary aphasia obtains, the life of the patient should be so regulated as to prevent marked variations in the vascular pressure, and rupture or thrombosis of the cerebral vessels. Careful study of the heart and blood pressure should be made and the influence of disease of the gastro-intestinal tract and the kidneys upon variations of the blood pressure should be determined. Diet and the exercise should be regulated

accordingly. Sudden overexertion is not as frequent a cause of cerebral hemorrhage as would appear from the statements made in the usual text-book articles. The exercise of the patient should, however, be so regulated as to prevent any sudden overexertion or marked fatigue. Kidney insufficiency as a result of moderate to marked grades of contracture is by far the most frequent cause of the high vascular tension preceding the rupture. This can be controlled for a short period of time by the nitrites and other drugs.

A proper regulation of the diet, bowels, exercise, and the administration of sufficient water to procure proper elimination will be necessary in chronic hypertension. The use of autocondensation and other forms of electrical waves may prove of some benefit. In some cases of marked hypertension, with kidney insufficiency and cardiac irregularity, digitalis preparations, by their action on the kidneys, will sometimes reduce blood pressure instead of increasing it. They must, however, be used with extreme caution and their effects noted by means of careful blood-pressure observations. Potassium iodide has been extensively used, but I have never seen any beneficial effects either in the prevention of cerebral symptoms or in the reduction of the blood pressure. Where syphilis is the cause of arterial disease, mercury in rare cases is sometimes of value. Recent reports by Wechselsmann and others appear to indicate that the "606" remedy of Ehrlich has a beneficial effect in this group of cases.

The treatment of the apoplectic attack needs careful consideration. The patient should not be removed from the place of the attack farther than is absolutely necessary for proper treatment. He should be placed in the full recumbent posture, with the head slightly elevated. If the respiration is markedly disturbed, either from accumulation of the saliva, in the larynx, or a deficient action of the respiratory muscles, he should be placed on the non-paralyzed side. In this position the saliva runs out more easily and the muscles of the chest on the non-paralyzed side are in better position to do their work. If there is evidence of cardiac overaction, with marked congestion and cyanosis of the face, venesection is indicated. From ten to twenty ounces of blood may be removed if the condition of the pulse warrants it. An ice-bag may be applied to the head and mustard poultices to the nape of the neck and the lower extremities. If consciousness does not return within a relatively short space of time, free purgation should be instituted by means of croton oil placed on the tongue. Starr suggests the use of adrenalin, either hypodermically or by rectum, when it seems certain that a hemorrhage is occurring. I have never felt justified in using this drug on account of the difficulty of diagnosing a progressive hemorrhage and the uncertainty of the action of the drug on the cerebral blood pressure.

In extensive hemorrhage the patient often presents all the symptoms of marked shock. Venesection is here contraindicated. The patient should be kept warm by the application of external heat, and stimulation may be necessary. All attempts at feeding or medication by mouth

should be avoided. Absolute rest should be enforced until the danger of further hemorrhage has passed. After the return of consciousness, milk in small quantities should be administered, and this later should be increased up to a full milk diet, care being used to prevent too much work being thrown on the heart in handling a too large quantity of fluid. The bowels should be kept open and careful attention should be directed to the bladder in order to prevent overdistention, or bedsores as the result of wetting the bed from incontinence.

If the attack is due to thrombosis as the result of hypertension, the treatment does not differ essentially from that above detailed. The nitrites may be given in fairly full doses. Thrombosis due to lowered blood pressure demands active stimulation, and cardiac stimulants may be given in full dosage. During an embolic attack the shock produced often necessitates full cardiac stimulation. Just as soon, however, as this stage has passed the nitrites in full dosage should be administered for a period of several days. In many cases brought to a hospital in an unconscious condition, an accurate diagnosis between hemorrhage, thrombosis, and embolism is not possible. Under such circumstances the patient should be kept quiet and no active measures other than those indicated from the direct symptomatology carried out.

The treatment of sequels of an apoplectic, thrombotic, or embolic attack often needs careful consideration. The restitution of function usually begins with the grosser movements of the extremities. With the restitution of function there is a coincidental spasticity dependent upon the original damage to the motor fibers, and also on the secondary sclerotic changes. When the lesion is in or near the cortex, as in the embolic group, the spasticity develops early and is of extreme grade. In embolic hemiplegia complete restitution of function, with very little spasticity, often occurs. In other cases, in which the destruction is complete or extensive over the motor areas, the spasticity may be of moderate or severe grade. In the relatively few cases of cerebral hemorrhage which survive an extensive destruction of the capsular fibers, the hemiplegia may remain flaccid, or spasticity may develop.

The first problem of treatment is the restoration of motor power, and the second the prevention of spasticity. No definite rule can be given as to how soon the patient should be trained in walking. This will depend, in the individual case, on a careful study of the cardiac condition and the general health of the patient. In the cases of cardio-renal disease complicating cerebral thrombosis or hemorrhage, the progress toward recovery may be retarded by a recurrence of the cardiac or renal insufficiency. Great care must be taken in fat people to prevent too much work being thrown on an already weakened circulation, by too early or too violent attempts at walking. The blood pressure here may be used as an index of the strength of the individual. The elimination of urine should be carefully watched. I have seen cases of this type who have been making apparently good progress toward recovery suddenly exhibit Cheyne-Stokes respiration with mental hebetude as the result of cardiac and renal failure. My rule of treatment has been to

proceed slowly and with great caution in hemorrhage cases. In the thrombotic and embolic cases much more rapid progress may be attempted. The patient is trained to stand at first with the support of two assistants, or against the foot of the bed, or between chairs, and just as soon as sufficient weight can be borne on the paralyzed extremity, a few steps are taken and the amount of exercise gradually increased from day to day.

If paralysis of the arm prevents the use of crutches, we must depend for artificial support of the cane on the non-paralyzed side, or in very fat individuals, after hemorrhage, a body carriage which supports the individual under the arm and may be pushed about may be used. In all cases of exceptionally high tension, or in cases of instability with marked variations in tension after effort, the bedroom should be on the ground floor if possible, and all attempts at stair-climbing or hill-climbing strenuously inhibited. During this period, and also while the patient is in bed, massage and Swedish movements may be employed with much benefit for keeping the muscles from getting soft and flabby, and also as an aid to general metabolism. Passive movements should be begun early and persisted in under careful supervision. In my experience they are of great value not only as an aid for keeping the muscles and joints in good condition, but also for hastening the return of volitional control.

Electricity, while extensively employed, has, I think, relatively little value. It will sometimes relieve the pain in the shoulder produced by the drag of the flaccid paralyzed arm. If used at all after the return of power and beginning of spasticity, it should be limited in its application to the extensor muscles of the arms and the flexor muscles of the legs. Here again I have found it of relatively little value, and I think more harm than good has been done by its application. In the milder grades of spasticity gentle massage under hot water will be found of much benefit. The patient is placed in a hot bath, as hot as can comfortably be borne, and gentle massage and passive movements carried out from a period of from five to fifteen minutes. Most patients cannot stand the relaxing and exhausting effects of this treatment oftener than every second day, and frequently not oftener than twice a week.

In the more severe grades of spasticity with marked contractures, Schwab and Allison have found that the injection of weak solution of alcohol into the nerves supplying the spastic muscles, if the dilution is properly gauged, results in a loss of spasticity with the return of fair motor power. Whether section of the spinal roots will give the same results as has been obtained in cases of general spasticity of the lower extremities remains yet to be determined.

In the small percentage of cases with relatively deep cerebral lesion, pains of moderately severe grade may be present throughout the paralyzed half of the body. These sometimes yield to the hot baths above referred to, sometimes to the application of static or galvanic currents, and rarely to the use of the analgesic drugs. On account of the chronicity of the affection, these drugs cannot be employed over any length

of time. The spasmodic laughing and crying from bilateral capsular lesions are not amenable to treatment.

Aphasia.—In right-sided hemiplegias, where the patient has lost the power of speech, much may be gained by proper training. In sensory aphasia, *i. e.*, the inability to understand written or spoken language, little can be hoped for apart from the complete or partial restitution which sometimes takes place spontaneously in the thrombotic group. In the motor aphasias in which the patient understands what is spoken and written, careful and painstaking efforts often result in the restitution of spoken language. This is more particularly true in the aphasias of early life. Several methods are employed, all of which follow in a general way the primary method of acquiring language in infancy. The patient is taught the use of the alphabet by means of block letters, and carefully trained by an association of the sound of the letter, the appearance of the letter, and a careful enunciation of the letter sound by an example of lip and respiratory movements. The same method is used with objects. A book is shown to the patient; the word "book" is carefully repeated, pointing to the object; the pupil is made to repeat the word "book," the printed word "book" is shown in relation to the object, and the patient made to copy the word both in its printed and written form, as an exercise. The retraining of aphasics is a tedious and often a discouraging task. The best results are obtained in childhood, although good results are often obtained in adults. The same method as above noted will sometimes succeed in sensory aphasia. The means employed should, of course, be adapted to the particular form of aphasia under training.

The mental deterioration often noted in cerebral lesions is partially the result of the disturbance of the speech mechanism. A retraining of the speech, and more particularly of hand motions in association with speech, is one of the most valuable aids we have in the restoration of the mental tone. In a bright, intelligent monkey I removed successively both arm centres. Without other surgical interference with the cerebral mechanism, there was a rapid mental deterioration to the point of marked imbecility. In the monkey practically all mental activity is associated with arm and hand movements. The removal of the cortical innervation disturbs this mechanism and leads to the mental defect. This, in spite of the rapid return of the automatic movements, such as running, climbing, etc. I had already noted, before this experiment, that in conditions of mental deterioration, convalescence would be hastened by occupations of varying degrees of complexity in which mental and manual activity are combined.

Cerebral Palsies of Childhood.—Several different pathological conditions underlie this clinical group. A spastic condition at birth or shortly afterward may be the result of prenatal influences resulting in hemorrhage into the brain, or into the meninges, a failure of the development either of the cortex or of the motor pathways at the time of birth, microscopic or gross hemorrhages into various parts of the brain. It may result from prolonged passive congestion of the cerebral veins. traumatism from the use of forceps, or thrombotic conditions from the

same causes. In infancy and early childhood the spastic paralysis may be the result of hemorrhage occurring after whooping cough, or after a convulsive attack. Non-suppurating encephalitis in the cortex and in the motor pathways may give a similar result. The preventive treatment of the spastic palsies of childhood depend upon the care of the maternal health during pregnancy and a sane attitude toward the use of instruments at the time of the delivery. Instrumental delivery should not be practised as a routine except in the hands of the most skilful, and it is a question whether it is even here justified. Prolonged labor, on the other hand, unassisted, is calculated to cause quite as serious results. The accoucheur should bear in mind in any event the ease with which the brain of a child may be irretrievably damaged and the necessity, in all prolonged and instrumental deliveries, of careful after-examination of the child to note all symptoms of injury. The prevention and treatment of hemorrhage in infancy is considered under the subject of convulsions of childhood.

The treatment of cerebral hemorrhage in infants does not differ from that above described in adults. Cushing has recently carried out an operative treatment in these cases which will be found noted under Surgical Treatment. The treatment of the athetosis and spasticity along surgical lines has already been considered. The treatment of the complicating epileptic attacks in these conditions does not differ, except in their hopelessness, from that detailed under epilepsy. A word of caution should be here stated as to the education and training of these mentally defective children. The education should be carefully guarded and in the hands of specially trained teachers of backward and defective children. The education and training should be under the supervision of a physician. Too much should not be attempted. In the higher grades, with relatively slight mental defects, a mental breakdown resembling simple dementia, or not infrequently a mental condition resembling dementia præcox, results from overeducation. The tendency of parents to waste money on these children, to the detriment of their normal offspring, should as far as possible be discountenanced. The more marked grades of mental defect, and particularly those with severe epilepsy, are more comfortable and better handled in farm colonies for the epileptic and feeble-minded.

ENCEPHALITIS.

Within recent years our ideas concerning the subject of encephalitis or cerebritis have been much altered. Extensive pathological studies by newer methods have shown the old idea of an extensive inflammation of the brain to be of questionable occurrence. It is true that in syphilis, a chronic parencephalitis, affecting especially the meningitis and cortex, may exist, but this is not an acute inflammatory process in the strict sense of the term. Oppenheim, in a masterly article, has digested this entire subject and has pointed out the existence of localized non-suppara-

tive areas of inflammation in the brain. These for the most part complicate the acute infections. The most important of these infections, from an etiological standpoint, is influenza. Scarlet fever and diphtheria are next in frequency. Several observers call attention to measles as an etiological factor. Whooping cough and erysipelas have occasionally been noted.

Pathological studies in cerebrospinal meningitis have shown areas of acute inflammation with relatively slight changes in the meninges. Areas of encephalitis without symptoms of meningitis with the diplococcus in the cerebrospinal fluid, have been described. Trauma unquestionably acts as a determining factor in the production of localized non-suppurative inflammation of the brain. This has been looked on in the past as the result of direct injury. The present view looks upon these areas of inflammation following trauma either as points of least resistance for infection by an organism circulating in the blood, or as a stimulation of a latent focus of disease into activity. There is no question that this actually occurs in relation to tuberculous foci, and may well occur in other conditions. This discussion, of course, does not refer to injury with fracture.

It is not the province of an article on therapy to go into detail concerning the symptomatology. Inasmuch, however, as it is impossible to treat these cases without some knowledge of the modern attitude toward the subject, I shall say a few words concerning it.

The onset in encephalitis is acute, without, however, the presence of headache, although this may be present. There is a slight rise in temperature, with rapidity of the pulse, marked weakness, some ataxia of the extremities, and the presence in some cases of an inflammation of the optic nerves. The mentality may be clouded and delirium may be present, more particularly in the influenzal group of cases. In addition to these symptoms there exists symptoms of localization depending on the area of the brain affected. If the cortex or subcortex is involved, disturbance of speech and monoplegia may be present. The lesions of the base of the brain near the aqueduct of Sylvius produce an ophthalmoplegia, a paralysis of all or some of the eye movements; if the pons is affected, an acute bulbar paralysis.

The first principle in the treatment of encephalitis is the determination of the cause, which should as far as possible be neutralized or removed. In diphtheria cases, antidiphtheritic serum should be administered early and in full dosage. Two cases have come under my observation in recent years, both following minor throat infections, with, however, the presence of Klebs-Loeffler bacilli in the throat at the time of the onset of the encephalitis. In one of the cases the course of the disease was progressive, *i. e.*, successive areas in the central nervous system being affected. The patient fully recovered, although both pons and medulla were involved. Such cases show the necessity of early and active treatment. Even when the localization shows a limited involvement, and when, apart from the paralysis, minor symptoms exist, absolute rest in bed should be insisted upon.

In a recent case under my observation, a child of three years was suddenly taken ill with a temperature of 104° , vomiting, marked restlessness, slight retraction of the head, and paralysis affecting the seventh nerve on the left side. Meningitis was immediately diagnosticated by the attending physician. The absence of the Babinski reflex or a well-defined Kernig's symptom and a sterile cerebrospinal fluid led me to a diagnosis of encephalitis. The temperature promptly subsided within a few days, the symptoms of meningeal irritation disappeared under rest in bed and the free use of calomel, leaving the paralysis of the face as the sequel of the attack.

While non-suppurative encephalitis exists as a definite pathological entity, it should be borne in mind that there is a tendency for this condition to result in abscess. This is particularly true of cases complicating pus-foci in the neighborhood of the brain. When the localization points to the temporosphenoidal lobe or the cerebellum, careful search for disease of the mastoid should be made and surgical treatment instituted in case it is found. When the temperature, slowing of the pulse, the blood picture, etc., indicate an abscess, it should immediately be relieved by evacuation.

When marked somnolence or delirium exists, the question of nutrition should receive careful attention. The same rules as to nursing as detailed under meningitis should be insisted upon. An ice-bag should be applied to the head and free purgation should be instituted. Oppenheim insists upon the use of calomel repeatedly, and quotes one of his cases in which this was kept up to such an extent as to produce a stomatitis. The use of mercury and iodide of potash has been employed sometimes with favorable, more often with negative, results. The fever is rarely of sufficient grade to call for treatment. Lumbar puncture has been tried by Lenhartz, Lichtheim, and others with negative results. The autopsies in this group of cases do not show any perceptible increase of cerebrospinal fluid, and unless there is evidence of intracranial pressure, this method of treatment, on account of the irritation produced, is contraindicated. Careful attention should be given to the cases exhibiting cardiac weakness. In the influenza and diphtheria groups delirium and cardiac irregularity, which may in some cases be progressive to a collapse, necessitate the careful and judicious use of alcohol and other cardiac stimulants.

MENINGITIS.

The treatment of the various types of spinal and cerebral meningitis must necessarily depend on the pathological type of meningitis and also upon the causative agent. It is necessary, therefore, for the physician to know, before attempting to treat a case of meningitis, the causative agent. With the refinements in diagnosis offered by the bacteriological and cytological study of the cerebrospinal fluid, this may be determined in the large majority of cases. It is also of some importance that the physician should know the portion of the central nervous system involved

in the meningeal process. A careful clinical study ought to give a fairly accurate localization. It is still further necessary to differentiate between inflammation of the dura mater (pachymeningitis) and inflammation of the pia arachnoid (leptomeningitis). Pachymeningitis may be either external or internal, depending on the surface of the membrane affected. Leptomeningitis may affect the convexity of the brain, the base, that portion of the base enclosed in the posterior fossa, or the meninges of the spinal cord. For purposes of therapy, we may divide *leptomeningitis* into the following forms:

1. Epidemic.
2. Tuberculous.
3. Septic (staphylococcus, streptococcus).
4. Pneumonococcic.
5. Typhoidal.
6. Influenzal.
7. Syphilitic.
8. Traumatic.
9. Otitic.

In all these varied types of meningitis three stages may be recognized both clinically and pathologically:

1. A stage of congestion with intense irritation.
2. A stage of serous, serofibrinous, or purulent exudation.
3. A stage of chronic adhesion in cases going on to convalescence or cure.

A chronic leptomeningitis may exist independent of infection, most frequently as the result of alcohol, less frequently as the result of lead and other forms of intoxication. In all forms of acute leptomeningitis, certain general principles of treatment should be adhered to. The most important factor in the treatment is careful nursing, and, whenever possible, a trained nurse, accustomed to handling nervous conditions, should be in charge of the case. It should be her duty to see that the patient is kept free from all source of sensory, physical, and mental irritation. This should be a matter of deliberative nursing intention rather than simple routine. In other words, the nurse should see to it definitely that there should be no unnecessary noise, no unnecessary talking, unnecessary walking, etc., in the sick-room. The room should be kept darkened, and particular attention should be paid to the bed-comfort of the patient. When retractions and spasmodic conditions exist, the position of the patient and the arrangement of the bedcoverings, pillows, etc., becomes an important matter. The bowels should be kept open and the bladder evacuated with the least possible irritation. This is of importance because of the necessity of the use of opium or some of its preparations for the control of the pain. Opium should not be used except when the pain is not kept in control by simple measures. An ice-bag should be applied to the head, and in mild cases will often be all that is necessary. Phenacetin and aspirin may be prescribed if too much depression is not produced.

In cases with intense restlessness, bromides alone or in combination

with chloral, in doses of fifteen grains of the former and five grains of the latter, will often be found of value. In some cases a hot bath once or twice a day will often be found of value in reducing the restlessness, and in the more intense grades of pain it will be found necessary to use opium or some of its preparations in rather full dosage. This is, as a rule, well borne, and its administration should not be too long delayed, on account of the rapid loss of strength and nerve-tone. Combinations of morphine and codeine with such hypnotic drugs as trional, veronal, cannabis indica, and paraldehyde will be found of value not only in reducing pain, but in inducing sleep and controlling restlessness. When meningitis proceeds to the second stage, with effusion of serum and hydrocephalus, consciousness is obtunded and these drugs can be gradually withdrawn. A rule of nursing should be established that the patient should not be disturbed or aroused except for purposes of feeding. It is necessary to keep up the nutrition of the patient, and light nutritious food should be administered every three or four hours. It often becomes a necessity on account of the mental condition of the patient, or inability to swallow, to resort to rectal feeding. In long-continued pain, counterirritation by the use of blisters applied along the posterior margin of the skull will often produce a beneficial effect, not only on the pain, but also on the other symptoms. Whether opium is used or not, the bowels should be kept freely opened, and in the early stages free purgation is advisable. The disadvantage of the use of opium in meningitis is mainly one of reduction of the secretions, and it may do harm unless effectual means are employed to prevent it. The temperature, if moderately high, should be controlled by sponge baths. Cold tub bathing, such as is used in typhoid fever, is sometimes of value in cases with exceptionally high temperature and in which the symptoms of cerebral irritation are not marked or have passed off, but in most cases it will be found to be deleterious on account of its irritating effect on the patient and the symptoms.

The convulsions complicating meningitis are symptoms of widespread irritation of the cerebral convex cortex. They may sometimes be controlled by the use of bromides and chloral. When they complicate the second stage, with symptoms of marked intracranial pressure, they may be relieved by a lumbar puncture. Lumbar puncture is one of the most important therapeutic measures at our disposal for the control of such symptoms as headaches, convulsions, etc., if properly used. It should be used early, both as a diagnostic and a therapeutic measure. It should be repeated at frequent intervals in cases in which relief of symptoms is produced, or in cases in which the fluid is under high tension and can be withdrawn in large quantities. This method of treatment, first suggested by Körner, is a valuable therapeutic measure. The use of sterilizing solution (lysol) has not been found of value. The use of continuous irrigation suggested by Hill and attempted by Cushing has not been found practical.

Septic Meningitis.—While meningitis secondary to pus foci in the various bone-sinuses, and more particularly in connection with the ear, would appear to be cases for immediate surgical interference, as a matter

of practical experience they often, before and after operation, call for special treatment. Not infrequently a neurologist is called to stay the hand of the surgeon in cases of meningeal irritation when there is a history of ear disease. In a recent case there appeared to be sufficient evidence of the effect of toxins of gastro-intestinal disease to account for symptoms of meningeal irritation, notwithstanding the presence of a previous ear condition. The further course of the case justified this assumption. Decision in a case of this kind, however, requires fine judgment and the assistance of an experienced trained specialist in ear conditions and their complications.

When pus foci exist with symptoms of meningeal irritation, radical operation and a thorough cleaning of all diseased tissues is indicated. I have seen cases and have pathological specimens to substantiate the presence of a meningitis secondary to pus foci in the ear adnexa without involvement of the dura mater and without lateral sinus disease. When there is evidence of a localization of this process, and when the structure shows a streptococcic organism, antistreptococcic serum or vaccines, etc., should be used. This will be found of little value in widespread meningitis, a part of a general blood infection. Vaccines may also be used for other pyogenic organisms.

Tuberculous Meningitis.—Tuberculous meningitis is usually considered a fatal affection. Fürbringer and others have reported cases of meningitis going on to recovery, in which tubercle bacilli were found in the cerebrospinal fluid. I have seen cases of healed tuberculosis of the meninges in patients dying of advanced pulmonary tuberculosis at the Henry Phipps Institute. These cases, however, are so rare that the mere mention indicates the very high mortality of the affection. An unfavorable prognosis should be given in every case. Ord and Waterhouse trephined the skull in one case with an unfavorable result. In view of the presence of marked pressure from within the ventricles in all fatal cases, trephining with repeated drainage of the ventricles might give some hope of recovery. Repeated lumbar puncture will often relieve many distressing symptoms. The patient should be kept as comfortable as possible by the use of anodynes.

Syphilitic Meningitis.—Syphilitic meningitis is, as a rule, subacute or chronic in its course; it may, however, run an acute, fulminating course. In either event, it requires a very active treatment. Mercury should be administered in full dosage, hypodermically. It has been my habit in these cases to use the bichloride in doses of $\frac{1}{4}$ grain injected into the deep muscles of the back daily. This is usually combined with a small quantity of eucaine, in order to control the irritation. I have not hesitated in urgent cases, when I was sure of my diagnosis and when the symptoms did not yield to this treatment, to add an inunction of one dram of mercurial ointment daily, and in one case as high as two drams. If results are to be obtained in the treatment of syphilis of the nervous system, they must be obtained early and before destruction of tissue takes place. If this occurs, they must be regarded as belonging to the group of hopeless invalids; for that reason one must not be too careful as regards the

production of ptyalism. While this is, of course, undesirable, favorable results must be obtained, if not without it, at least in spite of it.

A syphilitic element often enters into the production of meningitis apparently due to other causes. Whenever in an affection of the nervous system a definite syphilitic history is given, and when this is supported by a positive Wassermann reaction, mercury will be found a valuable adjunct in the treatment. As noted above under general considerations, it has been used extensively empirically, and its value in a certain group of cases may thus be explained.

The after-treatment of cases of syphilitic meningitis is of importance. My experience in the nervous wards of the Philadelphia Hospital has taught me that when a man or woman who has had a syphilitic infection shows symptoms referable to the nervous system, within the first two or three years, the tendency of the disease is to centre itself upon the nervous system, and accident follows accident unless active antisymphilitic therapy is kept up for a long period. I should not consider, in such cases, ten years too long a period for a yearly course of treatment with mercury. The Wassermann reaction may prove a valuable indicator for the occasional necessity of the mercurial treatment in such cases.

Meningitis Complicating the Infectious Fevers.—Meningitis not infrequently complicates typhoid fever, influenza, pneumonia, and rarely other infections. In the absence of any specific treatment of the infection, the meningitis must be treated along the lines above laid down.

TUMORS OF THE BRAIN AND MENINGES.

The treatment of tumors of the brain and meninges consists, in suitable cases, of their removal by operation, if their nature is such that they are not likely to be absorbed by medicinal treatment. Surgical intervention should, however, only be undertaken when there is a definite hope that it will accomplish some good. It is, for instance, contraindicated except to relieve pressure, in early cases, in malignant neoplasms of the brain or meninges complicating a primary tumor of one of the viscera. On the other hand, experience has shown that a syphiloma of the brain, unlike other forms of meningeal syphilis, is obstinately resistant to the action of mercury and the iodides, and if accessible may be readily shelled out by the surgeon. For this reason if a patient with a definitely localized cerebral gumma does not show marked improvement in the course of a few weeks through treatment by antisymphilitic treatment, as outlined in the consideration of cerebral syphilis, operation is indicated. To delay would mean to imperil the safety and perhaps the sight of the patient. As Cushing points out, one valuable criterion of the effect of the treatment and the need of early operation must rest with the condition of the eye-grounds. A choked disk may continue to grow progressively worse, even though the other symptoms of the patient may show signs of improvement. Tyroma, which constitutes the greatest percentage of the intracranial tumors, should, like its syphilitic congener, be subjected to

critical judgment as to whether operation should be used in its cure or palliation. It is undoubtedly true that well-localized tyromata may be removed with beneficial results in patients whose lung condition permits of operation. On the other hand, here the danger of meningeal dissemination from the trauma is a factor to be dealt with.

Cases are reported in which thorough antisyphilitic treatment had a beneficial effect on tumors of the brain other than gummata. Under the administration of mercury, sarcomata and gliomata of the brain have apparently become cystic, and thus to an extent retrogressed. While the use of mercury and the iodides should be persisted in in non-operable, non-specific cases, in hopes of some ultimate beneficial effect, their administration should not take the place of decompression in favorable cases.

The consideration of the various surgical procedures employed in the treatment of brain tumors is out of place in this work. Suffice to say that the surgeon should be a man of experience in brain surgery, and one with sufficient knowledge of neurology to appreciate the probable localization of the tumor as indicated by the symptoms of the patient.

The neurologist in charge of the case should always attend the operation in order to consult with the surgeon in directing the operation, and to prevent unnecessary handling, mutilation, and exploring of brain tissue. Cushing believes that tumors that cannot be well localized are more favorable for operation than those that can, and that it is not well to cut open a skull directly over a tumor on account of the tendency of the tumor to herniate through the opening and damage surrounding or covering structures. In decompressive operations, the skull should be opened over a "silent area." Cysts, when possible, should be extirpated, or the lining wall destroyed. Simple draining will not suffice to prevent a re-accumulation of fluid.

Lumbar puncture should be done in the diagnosis or treatment of cerebral tumors with extreme caution. Sudden withdrawal of the fluid may result in the closing of the foramen of Monroe, by a piece of tumor projecting into the ventricle, with subsequent deleterious or fatal results.

The x-rays are, as a rule, of little value in the location of the determination of the nature of the intracranial growth. They are, however, of the highest value in the corroboration of the diagnosis of tumor of the pituitary body; the enlarged or deformed sella turcica or rarefaction of the portion of the sphenoid bone beneath it, due to the existence of an enlargement, almost certain tumor, of that gland. Such tumors are readily removable.

As surgical science and art have progressed, there has been a gradual tendency to operate on tumors affecting parts of the brain previously not so accessible to surgical intervention. Such is especially true of those involving the cerebellopontine angle, from which situation tumors have been successfully removed. Formerly the operations on tumors attended with good results were confined almost entirely to those in which growths complicating the convolutions surrounding the Rolandic and Sylvian fissures were extirpated. The percentage of

cases of brain tumor that may be operated on with success is steadily increasing. It must, however, be borne in mind that success from a surgical standpoint does not correspond with success from a neurological standpoint. Too often the tumor recurs; in other cases the operation fails to relieve symptoms that make the patient's life a burden to him. In certain cases of non-removable tumors, decompression fails to afford relief, or the relief is only temporary. This does not, however, argue against the operation, which in certain cases offers some chances of alleviation and at the worst can only hasten the certain fatal outcome of a painful and protracted case.

Medical Treatment.—The medical treatment of brain tumor confines itself to the administration of drugs in operable cases, to relieve the symptoms previous to operation, and in inoperable cases to relieve symptoms and to make the existence of the patient as comfortable as possible. Mercury and iodides should be administered until it has been demonstrated that they are certainly of no value, or until the patient is no longer able to submit to their use.

For the distressing headache, coal-tar products, acetanilid, phenacetin, or antipyrin may be employed in full dosage, three or four times a day. These may advantageously be combined with cannabis indica in doses of three to five minims of the fluidextract. At night, veronal, trional, sulphonal, or, if these do not suffice, chloral, or even morphine, should be employed. Drugs must be modified or fortified in order to meet specific indications in the individual patients. Bromides to the point of tolerance may be given with the above-mentioned drugs to relieve pain, quiet the patient, and diminish or prevent the number of epileptic attacks.

Suitable regulations as to diet and the proper action of the kidneys and the bowels hold here as in patients with other nervous disease.

As the vomiting, nausea, vertigo, and optic neuritis are centric and dependent on increased intracerebral pressure, very little can be done to relieve them. Rectal feeding is indicated when nothing can be retained on the stomach. For the relief of the vertigo and ataxia, rest in bed is imperative. In early choked disk the room should be darkened. Leeches or cups to the temples may be of service. All sources of disturbance and annoyance to the patient should in these brain tumor cases be removed or excluded. The use of the nitrites or nitroglycerin in suitable cases will tend to relieve symptoms by a decrease in arterial pressure.

DISEASES OF THE SPINAL CORD.

Treatment of diseases of the spinal cord is for the most part an unsatisfactory chapter in therapy. Apart from acute inflammatory diseases, the majority of cases coming to the practitioner for treatment belong to the syphilitic or parasymphilitic group. Prophylaxis is the most important element in the treatment. When syphilis affects the nervous system, the treatment must be thorough and energetic. Most often the disease

is not recognized sufficiently early by the general practitioner, with the result that when the patient reaches the specialist too much damage to the nerve structure has resulted for therapy to be of much avail. Much of the evil results of syphilis of the nervous system could be avoided were it generally recognized that two or three years of active treatment is not sufficient to protect the nervous system from either syphilis or parasymphilitic disease. My own experience has taught me that ten years is not any too long for the use of mercury in the disease. The Wassermann reaction, as already mentioned, may prove of value in determining the necessity for active treatment. Inasmuch as this is a complicated test, not available for the average practitioner, the course of mercury should be administered in all cases of syphilis twice a year, for at least a month, for a period of seven, at least, and better ten years.

A clinical test of some value is the return of susceptibility to the use of the drug. A patient under my observation for the last ten years, who had been taking the same dose of mercury both spring and fall, at the end of nine years first showed beginning salivation from the use of the drug. As so many of the cases of syphilitic meningitis and tabes give a history of the active use of mercury, for a period of one, two, or three years, it behooves us to widen our horizon with reference to the length of time for active treatment. With the first onset of nervous symptoms, where the Wassermann test gives a positive reaction, syphilitic treatment should be immediately begun. It has been my custom to make use of two methods of treatment, and sometimes to combine them—the use of the deep mercurial injections of an insoluble salt or the use of mercurial inunctions. The salicylate of mercury may be given in doses of one grain once a week. This has the decided disadvantage in that we are not able to control the dosage when a rapid effect is needed; I prefer the use of the bichloride in the dose of $\frac{1}{4}$ grain, $\frac{1}{2}$ grain of sodium chloride, and $\frac{1}{16}$ to $\frac{1}{10}$ grain of eucaïne. If the case needs particularly urgent treatment after the first day or two, I add sufficient mercury, by inunction, to produce tenderness of the gums, and in this way to control the actual dosage as needed. In every case of syphilis of the nervous system the dosage ought to be regulated for the patient instead of following some abstract dosage recommended in a text-book. The injections should be given daily until twelve to twenty are given, depending on the case. This may be followed at an interval of a week by a course of iodides, beginning with a dosage of one grain and rapidly ascending until 10 grains, three or four times a day, are given. I am not in favor of the simultaneous administration of mercury and iodides, the so-called mixed treatment, and do not believe that any value is added to the mercury by the association with the iodides. If the symptoms continue, the mercury may be continued from three to four weeks.

If the case is taken sufficiently early, good results ought to be secured by this method of treatment. In some cases it will be necessary to keep the patient in bed on account of the involvement of the lower extremities. In minor involvement of the nervous system the patient may be up and about during the entire treatment. The bowels should be regulated and

kept open, and careful attention should be paid to the digestion and general physical vigor of the patient. In all such cases alcohol has a pernicious influence. If definite results are not obtained in a period of six weeks to two months, and usually even a shorter period than this, little may be expected in a curative way from further treatment. Every case coming under observation, quite irrespective of the length of time it has existed, should be given the benefit of a thorough course of treatment. Chronic cases sometimes react well when the previous treatment has been neglected or improperly given.

The tendency to recurrence of syphilitic manifestations of the nervous system should be thoroughly impressed on the patient, and even when a complete recovery has been obtained and the treatment continued over a sufficiently long period of time, the general health of the patient must be maintained. If the patient is under weight, overfeeding is essential. The blood should be examined at frequent intervals, and if an anemic condition exists, it ought to be corrected and the effect of the mercury carefully studied.

The introduction of an entirely new method of treatment by Ehrlich within the last year has apparently led to a complete revolution in the treatment of active syphilis. In a few reports at our disposal the use of the "606" remedy, paradiamidodioxarsenobenzoledihydrochloride, appears to have a beneficial effect upon active secondary syphilis of the nervous system as in other viscera. Destruction of the nervous system from syphilitic lesions occurs very rapidly. The remedy should be used as soon as the diagnosis is made. In doubtful cases a Wassermann test is imperative. The earliest manifestations of syphilis of the nervous system is frequently seen in the nerve supply to the eyes. Serious accidents often leading to blindness have been observed in the use of atoxyl and other arsenical preparations. Up to the present time few serious accidents have been reported from the use of "606," etc. Until a more extensive experience has demonstrated the freedom from such action, the possibility of such damage should be made known to the patient before the remedy is used. When a careful ophthalmoscopic examination shows a lesion of the optic nerve, if used at all, it would seem advisable to divide the dosage, giving the injections a few days to a week apart.

TABES DORSALIS.

It is questionable whether a case of locomotor ataxia once established is ever cured. In an extensive experience, both in hospital and private practice, I have seen only one case which was apparently the exception to this rule, and yet afterward demonstrated it. An active business man with much responsibility, came under my observation some ten years ago; he complained of pain in the lower extremities, and on examination showed loss of the left knee-jerk, the presence of the right only under reinforcement, the presence of Romberg's sign, and a slight dissociation of the superficial and deep sensation. Under rest

from business worries and an active antisyphilitic treatment both knee-jerks returned to an approximate normal. Shortly after this, a period of business stress necessitated the neglect of the treatment, with marked mental and nervous strain. When I again saw the patient at the end of three months, the knee-jerks were completely lost, the other symptoms had returned, and the patient was placed under the same treatment, but without success. The symptoms progressed slowly but definitely to an unquestionable *tabes dorsalis*. We may, therefore, assume that *tabes dorsalis*, once established, is, according to the nature of the disease, an incurable affection. We may, on the other hand, do much in some cases to retard the progress of the disease, in some cases apparently to arrest it for a time and to make the life of the patient more comfortable and livable.

The unfavorable prognosis should be made known to the patient. When this is inadvisable, on account of the mental condition, the family of the patient ought to be made fully and positively aware of the incurable nature of the disease, what the physician is trying to do, and what may be expected. Some cases run a relatively acute course and are absolutely resistant to any attempt to stay their progress. They often terminate in a period of from one to two years. Other cases run a very chronic course of from ten to twenty-five years. As far as antisyphilitic treatment is concerned, much may be done both in the way of prophylaxis and relief. It is not the province of this paper to consider the preventive treatment along the lines laid down by Metchnikoff; the reader may be referred to a full consideration of this subject in a paper by Raymond Spear in the *Navy Journal*. I feel confident that if every case of syphilis received proper treatment along the lines already laid down, both locomotor ataxia and paresis would be rare diseases.

Every case of *tabes dorsalis*, whether seen early or late in the course of the disease, should receive the benefit of a full antisyphilitic course of treatment. This is all the more necessary and advisable if the Wassermann reaction is positive. Our knowledge of this test is not sufficient to state whether, in the absence of it, the treatment should be still carried out in the presence of a negative test. My own feeling in practice is in favor of a trial of mercury even in the presence of a negative Wassermann reaction. In chronic cases mercury may be used to advantage at intervals depending upon the case. Patients often become close students of their own cases, and will be able to judge quite as well as the physician how often it should be used, and of how much value it really is. In other cases a careful study of the case and of the Wassermann reaction will be the index for treatment. In cases in which the progress of the disease has been arrested for a considerable period of time the development of new and advancing symptoms will indicate the necessity for energetic treatment. These remarks should not be construed in favor of an indiscriminate and reckless use of mercury in the disease; the administration of it should follow a careful study and accurate observation of the course of the individual case.

The iodides I have found of so little value that I rarely resort to their

use. I am fully aware that they have been extensively used, often in massive doses, but, in my experience, with no other results than to disarrange the gastro-intestinal tract with the production of pseudogastric crisis. So much depends upon the general vigor, that it is important that the gastro-intestinal tract should be kept as far as possible in full normal condition. The general well-being and the control of symptoms will often depend upon the general physical vigor. In some cases there is a tendency to rapid loss of weight. This must be overcome by over-feeding, temporary change of environment, and relief from business cares and worries. One rule of treatment should be constantly borne in mind. The patient, as far as possible, should never be confined to bed for any period of time; this often leads to the rapid development and the increase of the ataxia in cases in which it has previously been a relatively minor symptom. Every effort should, therefore, be made to keep the general health such as to minimize the necessity for bed treatment, and in cases where it should become necessary the patient should be ordered out of bed for a period each day, to keep the legs exercised. The patient should lead a life out-of-doors, should sleep when possible in the open air, and should, as far as possible, be free from worry and excitement. Alcohol should be absolutely prohibited; tobacco, if permitted, should be restricted to a small amount. The same is true as to tea and coffee. Moderate exercise is advisable and should always stop well within the point of fatigue; the same is true as to the mental exercise. Every effort should be made to keep the patient from the wheel-chair stage.

A patient who fights to retain his motor power, and more particularly if he can be trained to take a philosophic view of his misfortune, will suffer less, both mentally and physically, than he who gives in easily. This, however, is often a matter of general physical vigor, rather than of moral undertone. Hydrotherapy has a double value; it acts as a good stimulant tonic, and may be used to stimulate the peripheral circulation and sensory distribution. Hot, relaxing baths should be avoided. The tepid bath, short of relaxation, followed by a cold douche or a needle-spray, is advisable in selected cases. Cold plunge baths, if not too prolonged, are permissible in cases who react well and are free from rheumatic troubles; surf-bathing should be prohibited.

Both *electricity* and *massage* have a distinct value when properly employed; here, again, extremes should be avoided. The muscles should be kept in good condition; general massage should be combined with the various *exercise movements* first suggested by Mitchell and later elaborated into a system by Fränkel, for the control of the ataxia. Massage should be carefully regulated so as not to produce undue fatigue or excessive stimulation. Here, again, it should be borne in mind that the sense of fatigue is often lost and a fatigue reaction must be looked for in the pulse and general reactions of the symptoms. These same observations hold true for the exercises. While all patients who are able to move about at all without undue fatigue reactions may be benefited by the Fränkel system, those in which there is relatively little loss of muscular power, but with marked ataxia, show the best results. These exercises

are too elaborate and too complicated to be detailed in this article. They depend upon the reëducation of the individual muscle and the extremity, as a whole, to normal action. The patient is trained to stand and at first to use the eyesight to compensate for the loss of muscle sense. Simple training movements are added to this, such as touching a figure marked upon the floor with the toe. When the ataxic movements are fairly well under control, simple walking movements, with places for the feet marked on the floor, are added. More complicated walking exercises are then devised, such as following a snake-like course, figures of eight, etc., and finally movements of ascent and descent on real and artificial stairways. The reader is referred to the monographs of Fränkel,¹ Goldscheider,² Graupner,³ and Forster.⁴

Practically all forms of *electricity* have been tried, sometimes with benefit, more often with deleterious results. The best results are obtained by the guarded use of galvanism, or preferably faradism, to the spine and to the extremities. The mild irritation of the sensory paths will often prove of distinct benefit. It will sometimes relieve the exhaustion symptoms which do not disappear after proper rest. The same effect is reached by stimulation of the sensory nerve-endings by sand-paper massage. Much may be done to control the ataxia and to improve power by careful study of relaxed joint-conditions and their correction by light orthopedic apparatus (Schwab). The question of the shoes should receive careful consideration. The control of pain is one of the most important parts of the treatment. As a general rule, the more careful the general treatment, as above laid down, the less pain there will be, and the better the patient will be able to bear it without the use of analgesics.

A drug once highly lauded as a cure for the disease, and still of value in some cases for the control of the pain, is nitrate of silver. It, like all other measures, should be given with a firm suggestion of its value. Aspirin in combination with phenacetin will sometimes do good. Cannabis indica will sometimes become necessary and may be given alone or in combination with the above items. Morphine should only be given in terminal cases; and then with full knowledge of the necessity of increasing dosage. Not only here, but as a general rule in handling both functional and organic nervous cases, the patient should never be permitted to know the nature of the medicine employed.

The pains of the extremities will sometimes yield to the hot baths, hot poultices, cold applications, or uniform pressure secured by the application of two or three layers of roller bandages firmly applied. The treatment of the *crises of locomotor ataxia* calls for a careful analysis of all the factors of visceral and sensory activity associated therewith. Little result may be expected from rectal, vesical, or laryngeal crises if a condition of local irritation exists; if the urine is abnormal, or there is a condition of low-grade cystitis, this must first be corrected. The same is

¹ Die Behandlung der Tabetische Ataxie, etc., Leipzig, 1900.

² Anleitung zur Hebungs Behandlung, etc., Leipzig, 1904.

³ All. med. Centralztg., 1898, No. 38.

⁴ Physiologie u. Pathologie der Coördination, Jena, 1902.

true of irritation of the lower bowel in rectal crises. Potassium iodide has been responsible for many cases of so-called gastric crises. The gastro-intestinal tract must first be maintained in a condition of normal activity before other means are added. In laryngeal crises local catarrhal conditions must be sought for and relieved. In the most common of these, the gastric crisis, the stomach and bowels should be kept as far as possible at rest, hot applications should be applied over the stomach and the above mentioned drugs administered in full dosage. In some cases morphine may be required. In terminal cases with persistent pain, and where nausea and vomiting result from morphine, the deodorized tincture of opium may be used to advantage. In cases where the action of the kidneys is deficient it is well to relieve any intoxication from this source. The same is true of the bladder condition above referred to. In persistent and frequently repeated gastric crises, with marked loss of weight, resection of the spinal roots as suggested by Foerster and repeated by Cushing and others, will completely relieve the pain, and result in an increase of weight and vigor. I have had no personal experience with this method of treatment.

Chronic gastro-intestinal conditions not infrequently produce marked mental depression. Relatively little can be accomplished for the relief of mental depression unless the digestion is improved. The depression may be so intense as to amount almost to melancholia and may lead to attempts at suicide.

Diplopia of tabes may sometimes call for special treatment by means of training exercises. The treatment of optic neuritis by means of mercury has been subjected to much criticism, but may be employed guardedly if the condition of the nerve-heads can be carefully watched. Ascending doses of strychnine and galvanism have both been applied, but they should only be employed by expert ophthalmologists who have had experience and who can appreciate the necessity for care in their use.

Paradiamidodioxarsenobenzoledihydrochloride ("606") has been tried by Wechselmann in cases of tabes. His results are inconclusive. The destructive lesions were resistant to treatment. Symptoms of irritation, such as girdle pains, headaches, intercostal pains, dysphagia, showed some improvement. In one case relaxation of the rectal sphincter regained its tone to such a degree as to prevent leakage. He is not at all positive that the improvement in symptoms was due to the effect of the drug on the parasyphilitic process, and thinks it quite possible that it may have been due to mental suggestion or its general tonic action.

LATERAL SCLEROSIS; SPASTIC SPINAL PARALYSIS.

The treatment of spastic conditions, and more particularly those of unknown origin, is very unsatisfactory. Secondary paralysis or spastic paralysis secondary to syphilitic or other forms of sclerosis presents the same problem of treatment as the primary form. The general tendency is toward a progressive increase in the spastic condition. Massage

and passive movements while the patient is in a hot bath are sometimes of benefit. In cases where there is a tendency to contracture, the massage should be limited to the less spastic muscles. Electricity has a tendency to increase the spasticity rather than to relieve it. If used at all, it should, like massage, be limited to the less spastic group of muscles with the idea of producing a more even balance.

Two forms of surgical procedure have been introduced for the control of excessive spasticity—section of the spinal roots introduced and more recently practised by Spiller and others, and injection of alcohol in varying dilutions into the peripheral nerves. This latter method has already been mentioned in connection with spastic paralysis following apoplexy. Division of the spinal roots is not only a serious operation, but may be followed by serious complications. There recently died in my wards, at the Philadelphia Hospital, a patient with extensive trophic bedsores, following section of the spinal roots for spasticity. Results obtained by Schwab and Allison by a much simpler procedure would appear to be the more preferable method of treatment. The operation of injection of the nerves is a simple procedure and the dangers of complications practically nil.

Combined Sclerosis.—Three different varieties of this disease are recognized: A primary form, the so-called combined system disease, which is not amenable to treatment; a degeneration of the posterior and lateral columns, which is sometimes seen in syphilis of the cord with relatively minor changes in the meninges, and the treatment of which does not differ essentially from that detailed under syphilis of the spinal cord; the third variety, the so-called subacute combined sclerosis of the spinal cord, evidently of toxic origin. This latter condition is seen most frequently in cases of pernicious anemia, but may also complicate secondary anemia of severe grade. It is sometimes seen in advanced tuberculosis and has been noted as a symptom group in pellagra. The treatment of this group is the treatment of the underlying condition. If the anemia can be brought rapidly under control, the symptoms will slowly disappear. A patient under my care a few years ago, at the Philadelphia General Hospital, had a marked ataxic paralysis which entirely disappeared with the restitution of the blood to a normal condition. Too much importance cannot be attached to the use of massage in these cases. It must be carefully regulated and the effect noted, not only on the physical condition of the patient, but also on the blood picture. During convalescence the Fränkel method of treatment may be employed to overcome the ataxia.

Friedreich's Ataxia.—*The hereditary cerebellar ataxia of Marie* is not amenable to treatment. Drugs have no effect upon the disease process. The Fränkel treatment has been tried, but has not given satisfactory results. These patients should be kept in the open air, preferably in the country, and every effort made to keep the physical tone up to its normal state.

Disseminated Sclerosis; Multiple Sclerosis.—The causation of this disease is so obscure that an attempt to arrest or to cure it has not met

with satisfactory results. Much may be done to retard the progress of the disease by strict attention to the physical and nervous tone. The routine of life should be regulated as far as possible for the patient, strict attention being paid to the elimination of excesses and the regulation of exercise to a point short of fatigue. As in tabes, confinement to bed is to be avoided. The ataxia is amenable to reëducation exercises mentioned under tabes dorsalis. Rigidity of the extremities, which frequently occurs, may be relieved by counterirritation to the back and well-regulated Swedish movements. Hot baths, if used at all, should be carefully regulated and the patient kept under the observation of the physician, as they have a tendency to do harm rather than good. Drugs are of little benefit. The differentiation of multiple sclerosis from disseminated syphilis is a difficult and at times an impossible procedure. Whether the Wassermann reaction will serve to differentiate these two conditions remains to be shown. The similarity of the clinical picture of the two affections may explain the beneficial results obtained in a group of these cases by antisiphilitic treatment. The fact remains that in some cases, even with a negative Wassermann reaction, marked results follow the use of mercury in full dosage. Arsenic has proved useful in the hands of some, but my experience with it has been disappointing. Strychnine in full dosage in selected cases proves beneficial. In cases with spasticity it is likely to do harm.

Progressive Muscular Atrophy.—The muscular dystrophies, *amyotrophic lateral sclerosis*, and *syringomyelia* all belong to the group of hopelessly incurable diseases. The treatment of all of these is mainly symptomatic: the use of massage and electricity and attention to the general health of the individual. Favorable results have recently been reported by Beaujard and Lohermitte in syringomyelia by the use of the x -rays. These observations have yet to receive confirmation at the hands of other observers.

MYELITIS.

Inasmuch as true myelitis is always the result of an infectious agent, the first problem in the treatment is to determine as far as possible the nature of the infection. The examination of the cerebrospinal fluid should be made before treatment is begun. If the infectious process is such as will yield to specific treatment, this of course should be immediately begun. In syphilis the treatment should follow that already outlined under cerebral and spinal syphilis. If the infectious agent is the diplococcus of cerebrospinal meningitis, the Flexner serum should be used. I have seen a diplococcus closely resembling that of epidemic meningitis in the cerebrospinal fluid of myelitis complicating gonorrhea. It differed, however, in cultural characteristics both from the diplococcus of Weichselbaum and that of Neisser.

Spinal caries is so often the source of the infection that its presence should be carefully sought for. The x -rays will be of valuable assistance

in the detection. I am not here referring to the pressure myelitis of Pott's disease, which should also be borne in mind. Myelitis in a case at the Philadelphia Hospital was shown at autopsy to be due to necrosis of several vertebræ, produced by an aneurism of the descending aorta.

The patient should immediately be placed upon a water-bed and kept as far as possible at absolute rest until convalescence is established. These patients do best when kept in the open air. A recumbent posture on the back is better than a prone position, on account of the more complete rest secured. The theory of the depletion of the blood from the spinal column by placing the patient on the face has not been sustained in practice. If fever is high, and if pain be present, pyramidon, aspirin, and quinine may be used separately or in combination.

Immediate and constant attention should be given to the condition of the bladder. Incontinence or retention is usually present. The urine should be withdrawn by catheter, under antiseptic precautions, at regular intervals. If symptoms of irritation of the bladder be present, and even without this, it is advisable to irrigate the bladder with a boracic acid solution after each catheterization. If the reaction of the urine permits its use, urotropin should be given. A purge should be administered at the onset and the bowels kept open at least once a day. A careful nurse will see to it, and the physician should insist upon detailed attention to the skin, and more particularly that of the back. While bedsores are in some cases unavoidable, they can often be prevented by keeping the bed-linen dry and free from wrinkles, and constant attention to the skin by a gentle alcohol rubbing, followed by the use of a proper powder. If the skin has a tendency to dryness, the use of liquid vaseline is advisable. Points of redness may be painted with a weak nitrate of silver solution.

Massage, electricity, passive movements, or strychnine should not be used until all the symptoms of acute inflammation have disappeared. In long-continued acute cases the feet should be prevented from becoming fixed in a dropped position by the proper application of pillow supports to the toes. Muscular cramp in the extremities may be relieved by hot poultice applications, or may necessitate the use of veronal or hyoscine at night, and in some cases the use of morphine. When convalescence is well established, but not until then, massage, galvanism, and the hypodermic injection of nitrate of strychnine directly into atrophic muscles may be employed. In cases in which a spastic state of the muscles follows a myelitis, deep massage is contraindicated, and passive movements, the use of the hot bath, and the proper reëducation exercises will prove of value. Convalescence is hastened by the removal of the patient to a warm equable climate.

Landry's Paralysis.—*Acute Ascending Motor Paralysis.*—Landry's paralysis is a rare disease. It should be recognized for purposes of treatment that all ascending types of paralysis are not Landry's paralysis. It should also be borne in mind that in the epidemic forms of poliomyelitis the paralysis may follow an ascending type. Myelitis may, in rare cases, be of an ascending variety. Syphilis of the spinal cord may

sometimes affect first the lower extremities and then the upper extremities. In true Landry's paralysis there is no disturbance of sensation, the sphincters are not involved, and the loss of power presents the entire syndrome. In most cases, and probably in all, it is an infectious or toxic process affecting the anterior horns of the spinal cord. In one of my cases it followed a miscarriage followed by septic infection. In another case it was part of a pyemic condition. In still a third case, complicating a pulmonary tuberculosis, a mixed Klebs-Löffler infection was found at autopsy. If it is possible to determine the causative agent, this, as in the case of the Klebs-Löffler bacillus, may be counteracted by an antiserum. Any further treatment should follow the lines of the treatment of general infections. When the paralytic symptoms indicate that the medulla is involved, artificial respiration, oxygen, and cardiac tonics may be employed. The necessity for the use of such means indicates the fatal termination of the case. In rare cases the patient may recover.

Acute Poliomyelitis (*Infantile Paralysis*).—The work of Flexner and Lewis, following the steps of Landsteiner and Popper, places this disease under the group of the acute infections. They have been able to infect not only monkeys, producing a clinical picture similar to that of man, but have also been able to transmit the disease through a series of monkeys. Up to this time they have been unable to discover any bacterium. In the absence of any definite knowledge concerning the causative agent, treatment must follow along the lines of any other acute infection. During an epidemic we not infrequently find children presenting fever, malaise, nervous irritability for two or three days preceding the paralytic symptoms. A child presenting such symptoms should be confined to bed, freely purged, an ice-cap applied to the head and ice-bags along the spine. The diet should be limited to fluids. If paralysis develops, these measures should be continued, and lumbar puncture may be employed if there be severe headache. The symptoms of meningeal irritation may be so marked as to indicate the employment of the treatment laid down under Meningitis. In the mild cases the child should be kept in bed from two to three weeks, and in the more severe cases from four to six weeks.

After the symptoms of acute inflammation have subsided, passive movements of the paralyzed parts should be tried, at first two and then three or four times daily, with the idea of preventing contractures. After the fourth or fifth week, massage should be guardedly employed. With returning strength the patient should be encouraged to use the paralyzed extremity as much as possible. Massage should be continued, and some results may be perceptible as late as two years after the attack. To this should be added electrical treatment in the form of galvanism to the muscles which will not react to the faradic current. Great care must be used in the application of the electricity to young children on account of the fear produced. It is advisable at first to use the electrodes without any current, and later, as the confidence of the child is obtained, to use minimal currents and gradually to increase up to the quantity required. It is always advisable to encourage a child to get as much as possible

out of a paralyzed limb without the aid of orthopedic apparatus. Some cases will be materially aided by apparatus of light weight and properly adjusted. Contractures may necessitate tenotomy, and also in cases where one muscle or group of muscles become paralyzed while the opposing muscles retain full power. The portions of the healthy muscles may be transplanted and attached to the tendon of the paralyzed group. It then rapidly becomes accustomed to its new function. In two cases operated on at the Home for Incurables, the results were very encouraging. The splitting of nerves and their attachment to the nerve ends of paralyzed muscles has not given definitely satisfactory results. Children affected with infantile paralysis do better, as a rule, in the country where they can be outdoors most of the time. Ashhurst has recently shown good results by fixing the ankle-joints (arthrodesis), where the extensors of the lower leg were permanently paralyzed.

TUMORS OF THE SPINAL CORD.

Spinal tumors may be divided into three groups:

A. Those originating in the bones of the spinal column and secondarily affecting the meninges and the spinal cord either by infiltration or by pressure.

B. Tumors of the spinal meninges with involvement of the spinal cord by pressure or extension.

C. Medullary tumors originating in the spinal marrow. Schlesinger collected 400 cases. Of these, 126 were intramedullary and 239 were extramedullary. Of the 239 extramedullary tumors, 151 were intradural and 88 extradural. For purposes of treatment, we may divide these tumors into operable and inoperable; the majority of the cases of the inoperable group belong to the intramedullary type. Inasmuch as it is often difficult to decide as to the nature and extent of a spinal tumor, an exploratory operation is advisable in all cases where the spinal growth is localized and dominates the clinical picture. Tumors complicating advanced carcinoma of other organs, extensive sarcomata, etc., are excluded from operative procedure.

It is the duty of the neurologist to be present at all such operations, and not only on the spinal cord, but also at brain operations. The surgeon, as a rule, cannot resist the temptation, having exposed an inoperable case, or one in which the appearance of the tissue has not confirmed the clinical diagnosis, to handle and press upon the delicate nervous structures, and thereby do considerable harm. I have in my collection sections of cortical tissue showing extensive pericapillary hemorrhage as a result of such procedure. If the tumor is not exposed at the place of operation, it is advisable to remove one or two laminae higher up. The mistake is more often made by localizing too low, rather than too high. An examination by the *x*-rays should always precede operation on the spine, whether it appears to be indicated or not. The after treatment even in successful operations, requires the applica-

tion of movements of reëducation to overcome the ataxia when present, and the measures already outlined for the treatment of rigidity when it exists as a persistent sequel. Massage and electricity and the measures for the general restoration of the health and the nutrition of the patient may be indicated.

In the inoperable group of tumors much may be done to make the patient comfortable. Pain is often a distressing symptom, and calls for the use of analgesics. In the progressive hopeless cases we need have little hesitation in the use of opium and its preparations if the pain cannot be relieved by other measures. If opium or its derivatives does not relieve the pain or the muscular spasms below the point of lesion, section of the posterior roots, as suggested by Buzzard, may be considered. If cramp-like spasms alone are the source of trouble, the injection of alcohol into the peripheral nerves, as practised by Schwab, might be tried. The same attention must be paid to bladder and rectal trouble as indicated under myelitis. If the life of the patient is to be prolonged, open-air treatment will tend to prevent the development of the bronchitis and bronchopneumonias which not infrequently terminate the case. Antisyphilitic remedies have been extensively used in obscure tumors of the spinal cord and those which belong to the inoperable group. The difficulty of stating definitely the nature of an intraspinal growth and the frequency of gummata of the nervous system warrant the administration of mercury preliminary to operation in cases in which the development has been extremely slow and when the need for immediate operation is not urgent. In operable cases mercury may be guardedly tried and sometimes gives good results, even in non-syphilitic cases. In one of my own cases the gross and microscopic examination of the brain showed the transformation of a sarcoma of the cerebellum into a cyst with a small rim of tumor mass outside its walls. In this case mercury had been administered in full dosage in the medical wards of the hospital, on the assumption that the tumor was of syphilitic origin. The improvement and disappearance of all the symptoms of cerebellar tumor for a time supports the conclusions from the pathological examination above referred to. Starr, also, reports cases of sarcoma reacting favorably to mercurial treatment. This much may be said of the Wassermann reaction in the diagnosis of these cases: When positive, it indicates that the patient has had syphilis, but it does not follow that the tumor under consideration is necessarily of syphilitic origin. When the test is negative, it is not conclusive either for or against the syphilitic nature of the affection.

NEURITIS.

In order to treat a case of neuritis with any degree of success, it is essential to understand not only the cause of the neuritis, but the nature of the pathological process. Three essential forms of neuritis from the pathological standpoint may be recognized:

1. An acute inflammation in the strict sense of the term, *i. e.*, an acute interstitial inflammation—interstitial neuritis. In this form the nerve is swollen, due to an accumulation of serum; there is an out-wandering of both red blood corpuscles and leukocytes into the interstitial tissue, and there is both a primary and a secondary degeneration of the myelin and axis-cylinders as a result of both inflammation and pressure. This presents all the chemical manifestations of an inflammatory process, *i. e.*, the heat, the redness, the swelling, the pain, and the abolition of function.

2. A parenchymatous or degenerative neuritis—a toxic degenerative process with little or no inflammatory reaction, with little or no pain, swelling or redness, but with a marked disturbance of function.

3. A traumatic neuritis due to pressure, in which a secondary degeneration results from the local injury. This may be acute or chronic in its origin, *i. e.*, it may develop from a sudden blow, or develop from a slow, gradual pressure. The third variety, of course, does not include those cases in which a stab wound or bullet wound causes injury to the nerve with secondary inflammation. Such a condition belongs to the first group of interstitial inflammation. It may be stated, as a general rule, that all cases of neuritis not due to traumatism are due to a toxic or infectious agent. All the forms of neuritis may run an acute, subacute, or chronic course. They may be chronic from the beginning, or an acute case may degenerate into a subacute or finally a chronic variety.

From the etiological standpoint of the various infections, some produce the interstitial variety of neuritis and some the degenerative type. Typhoid, influenza, beri-beri, leprosy, syphilis, malaria, erysipelas, rheumatism, and the plague produce an interstitial type of neuritis, with painful manifestations. Diphtheria and tuberculosis, on the other hand, produce a parenchymatous neuritis without pain. Toxins of the alcohol type produce an interstitial type of neuritis, whereas lead and arsenic produce the parenchymatous, degenerative type.

It should be recognized in the treatment of neuritis that not infrequently mixed factors may be at play, the symptoms of the neuritis being modified thereby. Pressure on a normal nerve during sleep practically never produces a condition of persistent paralysis. If, however, the recuperative tone of the nervous system is lowered by some toxin, such as alcohol or syphilis, a pressure neuritis not infrequently results. Lead and alcohol are sometimes seen in combination. Arsenic and rheumatism as factors are sometimes seen in chorea cases.

On account of the severity of its manifestations, the acute multiple neuritis seen in chronic alcoholics, and the endemic neuritis of beri-beri, will receive separate consideration.

Neuritis, as a rule, affects isolated nerves or groups of nerves. The most common determining factor as seen in practice is exposure to cold. For this reason these cases are usually regarded as rheumatic. Before treatment is decided upon, a careful painstaking history and painstaking examination should place the responsibility for the local phenomenon. I have seen in the last seven years, in my work at the Henry Phipps Insti-

tute and the White Haven Sanatorium, a number of cases of neuritis of the interstitial type, limited in distribution to the brachial plexus, and complicating pulmonary tuberculosis with mixed infections, and located on the side of the lesion. The cure of these cases depended more on the control of the tuberculous process and the mixed infection than on local treatment.

Not infrequently, in cases of sciatica diagnosticated as rheumatic, pelvic examinations will reveal a newgrowth or adhesions as the cause of the condition. In degenerative neuritis, affecting the soft palate, the extra-ocular muscles and the lower extremities in succession should always suggest an examination of the throat for a diphtheritic infection. Rheumatism, as the cause of neuritis, is so easy to diagnosticate and so hard to substantiate that it is only justified after a careful exclusion of other factors.

The success of treatment of a case of neuritis will depend largely upon the control or the removal of the cause. Apart from this, the first essential in the treatment of a neuritis is absolute and complete rest of the part. Failure in securing results in the treatment of acute neuritis is most often due to failure to remove the cause and carelessness in insisting upon absolute rest. In neuritis about the arm and shoulder this can be secured in only one of two ways—by the application of a splint or by securely binding the arm to the chest. When the leg nerves are involved, the patient should be confined to bed, and, if necessary, splints or sand-bags should be employed. Before this method of treatment is employed the physician should be certain that he is dealing with a case of neuritis and not one of hysterical pain. I have on several occasions seen harmful results follow the concentration of the attention of the patient by this method of treatment in hysterical pain.

If the tenderness is not confined to the nerve, if the sensory disturbance and loss of power do not extend to the distribution of the skin and muscles supplied by the nerve, and particularly if the reflexes and muscle-tendons supplied by the nerve are not lost, it may be safely assumed that the case is not one of neuritis. In an extensive experience, I have never seen a case in which the course of the disease and the electrical reactions of the muscles confirmed the diagnosis, in which the reflexes in the muscles supplied by the nerve were present. I am fully aware that the text-books speak of an early stage of neuritis in which the reflexes are increased, but until I have seen such a case properly studied and tested I will refuse to accept it, the authorities to the contrary notwithstanding. I am a firm believer in the efficacy of blisters, both for their effect on the pain and for their curative influence on the pathological process. They should be applied as early as possible in the course of the disease along the line of the nerves. The blister should be sufficiently wide to leave a distinct impression, one-half to one inch wide and one inch long. Just as soon as the acute symptoms of the first blister subsides, a second blister should be applied immediately below it or above it, as the case may be. This should be continued during the course of the affection. It is often advisable to apply the blister above the area of neuritis. In the

resistant subacute cases the actual cautery will often have a more beneficial influence than fly-blisters. Caution should be observed in the application of blisters to portions of the skin which are anesthetic on account of the lack of trophic power and the tendency to sloughing.

The control of pain in the acute stages of neuritis is often of so intense a character as to require the immediate attention of the physician. Morphine should be given in full dosage in the early period. The dose should be reduced as soon as possible and phenacetin and aspirin substituted. In the chronic case morphine should not be used, on account of the possibility of producing a habit. Cocaine or eucaine is of decided value, and injected along the course of the nerve seems to have an influence in reducing the intensity of the inflammatory process. It should be injected at the spot of most intense pain and tenderness.

Hot or cold applications along the course of the nerve will often prove of distinct benefit in relieving the intensity of the pain. The more absolute a part is placed at rest, the less necessity there will be for drugs and other measures after the first twenty-four hours. Absolute rest in bed with free purgation and a simple diet should be ordered in all cases, even in local nerve inflammation, when satisfactory results are not obtained after twenty-four hours of treatment. After the acute symptoms have subsided, the application of dry heat by means of a baking oven will often prove beneficial. In some cases moist heat gives equally good results.

The use of drugs as curative agents will depend, to a certain extent, upon the cause. In the rheumatic and gouty cases a milk diet, the free use of alkaline waters, and the administration of the salicylates, aspirin, colchicum, and salicin often prove of benefit. This treatment is often successful in cases in which a rheumatic element is not discernible. In cases of obscure origin the local application of a mercury and belladonna ointment will likewise often prove beneficial. In the malarial forms of neuritis, quinine in full dosage produces prompt relief. In syphilitic neuritis or in those forms of neuritis in which syphilis plays a part, mercury should be administered in full dosage, either by inunction or by hypodermic medication. The iodides and bromides will often prove of benefit in the rheumatic and syphilitic cases and those of obscure origin. A case treated from the beginning should not be permitted to become chronic. While this is sometimes impossible on account of the nature of the affection, more often it is a matter of negligence on the part of the physician in permitting the part to be used too early, in not securing absolute rest in the acute stage, or in permitting the causative agent again to become active. The affected limb should not be used until all pain and tenderness have subsided, and then at first only gradually. If the pain again returns, the part should be placed at absolute rest and a course of active treatment again reinstated. As soon as the pain and tenderness have subsided, much relief is afforded by the application of the galvanic current. This should be given in small doses with the anode over the affected part. It should be applied in gentle stroking

movements. Massage should be used only in the chronic cases, or in acute cases after all pain and tenderness have subsided.

Not infrequently the physician is called upon to treat chronic neuritis, long existent, and which usually proves very resistant to treatment. These cases require the most painstaking examination to determine the cause, which should always be done with the idea of the removal of it. It is my policy to begin treatment as if they were acute cases, in applying the procedures as above outlined. Various means of treatment have been suggested for this group of cases; surgical procedures, as nerve-stretching, nerve-suturing, acupuncture, the injection of drugs along the course of the nerves, painting the entire course of the nerve with hydrochloric acid, and more recently the injection of 50 to 100 c.c. of normal saline solution into the sheath of the nerve. These various measures can be tried in conjunction with the procedure outlined above. The injection of saline solution into the sheath of the nerve is by far the best measure. Bumm, in resistant cases of sciatica, reports complete cures in forty-two of the seventy-three cases. The injection should be made into the upper portion of the nerve and repeated as often as three or four times. Acute pain referred to the peripheral course of the nerve, paresthesia, and muscular spasm are produced when the needle enters the nerve. The injection should be made slowly and full antiseptic precautions should be followed. Various forms of electrotherapy have been employed for the chronic cases. Static electricity properly employed will often give distinctly beneficial results. Galvanism applied with large electrodes and carefully measured currents will in some cases give equally good results.

In the chronic rheumatism cases, Turkish baths, the application of the baking machine, and a proper dietetic regimen must be insisted upon in conjunction with the other measures. The general nutrition and the condition of the nerve tone of the individual are too often neglected, not only here, but in other chronic conditions of the nervous system, as an important factor in treatment. A waste of nervous energy from overwork, emotional overstrain, etc., has as pernicious effect in a rheumatic or gouty individual as an alcohol debauch. Carefully devised full or careful rest treatment, with overfeeding in those of deficient weight and nutrition, is quite as important as a reduction treatment in those over-nourished.

In the toxic neuritis of the infectious fevers, the general nutritional condition of the patient must receive careful attention. Loss of general physical vigor in cases of the postdiphtheritic type is not infrequently responsible for serious consequences. In the metallic group the condition of the blood should be carefully watched and built up if need be. While the local condition may, and usually does, dominate the clinical picture, the general visceral condition should receive careful attention. In long-continued cases, not only of this, but of other conditions, it has been my policy at not too long intervals to make a complete reëxamination, as if I were dealing with an entirely new case. It is surprising how minor complicating matters so detected, and often developing during the course

of the treatment, have a distinct value in keeping up the local symptoms. Flat feet, loosened sacro-iliac joints, and other arthritic conditions would, unless corrected, produce sufficient disturbance to disable a part after the chronic inflammation of the nerve of the leg has subsided. Chronic joint conditions are not infrequently responsible in a reflex way for extensive atrophy of the muscles. A neuritis may or may not complicate such a condition. It is not the province of this article to consider the treatment of such joint conditions, but simply to call attention to them. A neuritis of the deep nerves in the neighborhood of the shoulder-joint, with or without evidence of arthritis, presents an obscure painful affection requiring careful diagnosis and treatment along the lines above laid down.

Special Nerves.—The treatment of diseases of neuritis affecting the first, second, third, fourth, and sixth cranial nerves falls within the specialties of the nose and throat.

Neuritis of the Fifth Nerve, or Trifacial.—An acute neuritis of the fifth nerve is not infrequently seen in rheumatic individuals after exposure to cold. In this condition there is intense pain, not infrequently in connection with a slight tic movement, involuntary in nature. I have seen this condition also in association with a neuritis of the seventh nerve (Bell's palsy), and in one case with a neuritis of the sixth nerve with an external strabismus. Gowers mentions two cases of optic neuritis associated with neuritis of the seventh nerve, and one in association with rheumatism, all of which followed exposure to cold. It is very difficult to differentiate actual neuritis of the fifth nerve from the reflex neuralgic conditions. I have seen reflex neuralgic conditions secondary to irritation of the teeth by caries or improper fillings, brought on by exposure to cold, such as riding in automobiles, closely resembling actual neuritis. In actual neuritis there is distinct loss of power in the motor power of the fifth nerve as manifested by weakness in chewing movements. I am inclined to believe slight grades of inflammation of the fifth nerve are prolonged and accentuated by points of irritation in the fifth nerve distribution. For this reason all forms of reflex irritation should be eliminated. This will be considered more in detail under the treatment of neuralgia. In actual neuritis it is not considered advisable to apply stronger counterirritation than that secured by a mustard poultice over the exit points of the branches of the fifth nerve. A milk diet should be prescribed and the jaw kept as much at rest as possible. In the rheumatic cases the salicylates should be employed in full dosage, and a combination of aspirin and phenacetin, in doses of from seven to ten grains each, will often prove beneficial in the control of pain. In rare cases the opiates may be found necessary in the early stages.

Chronic neuritis of the fifth nerve has been considered and is still considered in most text-books under trigeminal neuralgia. For ease of reference, this subject will be considered under that heading.

Neuritis of the Seventh Nerve (Bell's Palsy).—Paralysis of the seventh nerve may be due to a lesion (tumor, encephalitis, abscess) of the nucleus of the seventh nerve in the pons, meningeal disease, inflammation or

tumor at its exit point at the base of the brain, pressure or inflammation by extension from disease of the middle ear, or an infectious inflammation (rheumatic, so-called) in the Eustachian canal with secondary changes at the exit point and in the peripheral distribution. The treatment of lesions of the nucleus is considered under tumors, encephalitis, etc. The treatment of paralysis of the seventh nerve secondary to bone disease will depend upon whether it precedes or complicates operations on the middle ear or the mastoid. Paralysis complicating disease of the middle ear indicates, as a rule, operative interference. The results as far as the seventh nerve is considered are, as a rule, unfavorable. The treatment does not differ essentially from that considered below in the unfavorable forms of neuritis due to other causes. Paralysis of the seventh nerve, complicating an operation on the mastoid, may be either of a temporary or a transient nature, or may, on the other hand, be permanent. The power of the facial muscles should be tested as soon as the patient recovers consciousness after all ear operations. If there is a complete loss of power on the operated side at that time, it may reasonably be assumed that the nerve has either been injured or severed during the operation. If the paralysis occurs within twenty-four to seventy-two hours, it may be due to a slight injury during the operative procedure, or it may be the result of a temporary congestion following the removal of necrosed bone, or an infective inflammation may have been produced. If the injury is slight, or if there is simply a congestion, the paralysis disappears within the course of a few days. If the injury is severe, or if there be an inflammatory reaction, the prognosis is unfavorable. The paralysis is very likely to be complete and permanent.

The paralysis of the seventh nerve due to a rheumatic infectious agent may be the result of a simple congestive process, or a moderate or severe inflammation. I have seen a complete paralysis of this nature disappear, under proper treatment, in from seven to ten days. In the more severe grades of inflammation partial or complete recovery in a portion or in the entire distribution of the nerve may be obtained in from six weeks to two years, or the paralysis may be hopelessly permanent from the beginning. If the patient is seen in the early stages, a blister one and one-half inches square should be applied at the exit point of the nerve below the ear. Free purgation should be established, a vegetable and salt-free diet should be ordered, large quantities of an alkaline water prescribed, and the patient placed on a full antirheumatic medication. Salicylates and aspirin, in full dosage, and sodium iodide, in from two to five grains, give the best results. Local treatment should not be attempted for at least two or three weeks. Electricity and massage may then be employed carefully and guardedly. Too early or improper use of electricity, according to Mendel, and this has been true in my own experience, not infrequently leads to secondary contractures. If, in order to obtain contraction of the muscles, it is necessary to use electricity in sufficient quantity to give pain, it should not be employed. The galvanic current is the only current of value. If after two or three weeks contractions are obtained by faradic current, the paralysis will be of such

a mild character as to be relieved spontaneously without its employment. If the reactions of degeneration are present, and better contractions are obtained by the closing of the anode, this should be used. If, on the other hand, a better contraction is obtained by the cathodal closure, this should be used. The patient should be encouraged to attempt the voluntary use of the muscles upon which the electricity is being applied. With slight return of motion the patient should attempt simple and resistive movements in front of a mirror at prescribed intervals. Massage should be used in conjunction with the electrical treatment, either as electrical massage, the electrodes being used for rubbing purposes, or in the form of simple massage, carefully regulated. Operation in cases which show no return of motion after three months of careful treatment should be considered. It should not be too long delayed. The earlier the operation, the better the chance for the full recovery of function. I refer, of course, here to a transplantation operation in which either the spinal accessory or the lingual is attached to the severed stump of the facial. The technique of the operation will be found considered in surgical works.

Neuritis of the spinal accessory and hypoglossal nerves due to rheumatism have been described.

Neuritis of the Pneumogastric Nerve.—Neuritis of the pneumogastric nerve is most often observed as a pressure symptom in tumors, aneurisms, etc. It may, however, dominate the clinical picture, as in a case reported by Spiller. The fatal termination with cardiac manifestations in diphtheria, scarlet fever, and some mineral poisonings has been attributed to a pneumogastric neuritis. In all such cases the removal or neutralization of the cause is indicated. In toxic forms, the treatment is mainly symptomatic. Cardiac stimulants, strychnine, caffeine, atropine, and digitalone have been extensively used, with, however, equivocal results.

Pressure Radial Paralysis.—This condition usually results from pressure upon one of the brachial nerves during the period of alcoholic sleep. Other forms of intoxication, such as syphilis, rheumatism, etc., may act as etiological factors. The muscular spiral nerve is usually involved, giving a unilateral wrist-drop. Pain is never a prominent symptom and is usually absent. Anesthesia is very rarely observed. The cause should be immediately removed, and in the alcoholic group this beverage should be absolutely interdicted. Active counterirritation should be applied early, and treatment with massage, Swedish movements, and electricity should be begun as soon as local irritation has subsided. Isolated neuritis of the other brachial nerves, ulnar, median, circumflex, etc., should be treated along the same lines.

Neuritis of the brachial plexus is a severe affection; it is very resistant to treatment and demands active measures from the beginning. The treatment does not differ from that above laid down for single nerves. The same is true for neuritis affecting the lumbar and sacral plexuses.

Meralgia Paræsthetica.—A condition of numbness and paresthesia on the external surface of the leg has been attributed to an inflammatory condition of the external cutaneous nerve. The application of faradic

electricity in the chronic stage appears to give better results than other methods of local counterirritation. A careful search should be made for pressure from corsets, waist-bands, etc.

Sciatica; Sciatic Neuritis.—Pain in the distribution of the sciatic nerve is a very common complaint. It may be due either to an actual nerve lesion, neuritis in the broader sense of the term, or may be a functional disturbance, *i. e.*, neuralgic. If the condition is due to a neuritis, the treatment should be of the most thorough character. The possibility of pressure from disease within the pelvis and of the muscular tissue through which the nerve passes should be borne in mind. In all cases a pelvic examination should always be made preliminary to starting treatment. A case I saw several years ago resisted treatment at the hands of many physicians, and at autopsy was found to be due to a chronic tuberculous condition of the pelvic muscles. Rheumatism is the most frequent cause. Absolute rest in bed should be insisted upon from the beginning. If necessary, a splint should be applied to the limb, an antirheumatic régime should be insisted upon both in the matter of diet and drugs, and general massage to all parts of the body, with the exception of the affected limb, administered. Counterirritation throughout the course of the nerve, either by actual cautery or by blisters, should be applied until the acute symptoms subside. Morphine, if used at all, should be limited to the early stages of the affection. Salicylates should be given in full dosage and combined with small doses of the iodides.

Cases of the chronic neuritis will often yield to the very thorough application of the above measures, the case being treated as one of acute neuritis. This is more particularly true of cases in which the early treatment has been inefficiently or slovenly applied. Many methods of treatment have been devised for the chronic cases; deep massage and stretching movements will sometimes give excellent results. Galvanism or faradism applied with long electrodes covering a large portion of the nerve will give a more satisfactory result than when applied with small electrodes over localized areas. The static spark will sometimes give startling results. It is of special value in cases in which there is a large functional element. The use of the injection of large quantities of distilled water into the sheath of the nerve has already been mentioned. Stretching of the exposed nerve is applicable in a small percentage of selected cases.

Multiple Neuritis.—Multiple neuritis due to *alcohol* must be looked upon not as a local condition affecting the nervous system, but as a disease affecting many important visceral tissues of the body. Such cases often present evidence of marked intoxication, due evidently to secondary disturbances of metabolism. In the severe and fatal cases the clinical picture is not unlike that seen in typhoid fever. In treating a case of this disease, the alcohol should be withdrawn as soon as possible without precipitating an attack of delirium tremens. The diet should be a full milk diet. Careful attention should be paid throughout the disease in securing a competent action of both the liver and kidneys. The heart should receive careful attention from the beginning, on account

of the tendency to cardiac failure. This can best be protected by relieving the general intoxication. This latter is best secured by flushing out the system with large quantities of fluid, free action of the bowels by chologogue and hydragogue cathartics, and mild stimulation of the heart and kidneys. Complete rest of the body and of the mind should, so far as possible, be secured. From the standpoint of the nervous system, the pain and tenderness call for measures of relief. There is a great temptation to use opium or some of its preparations; but it should be remembered that by so doing their action on inhibiting the secretions may have a deleterious result. One must balance carefully the harm to be expected from the opium preparations on the one hand, and the rapid loss of nervous energy from the severe pain on the other hand.

Blisters are contraindicated in the active stages on account of the widespread areas involved, the discomfort and the danger of trophic disturbances. Hot poultices may be applied three or four times a day to the areas of most intense pain. Towels wrung out of hot water may be applied in the same way. When the condition of the patient warrants it, a not too hot bath will be of service. The salicylates have been extensively used and sometimes prove of value. In cases with a syphilitic history and often in cases without, mercury appears to give good results. Convalescence from multiple neuritis requires careful nursing and constant attention. During the acute stage, care should be used to prevent toe-drop and other deformities. During convalescence the muscles should be kept in good tone by gentle massage and the joints kept free by graduated movements. In getting the patient out of bed, care must be used. The inflammation must have subsided and the patient gathered sufficient strength to stand the amount of time prescribed. Walking movements must be begun slowly and gradually increased. Galvanism may be used to increase the tone of overweakened muscles. The extensors of the leg require extensive treatment on account of the tendency to toe-drop and the interference with the gait.

In chronic alcoholics, mental symptoms, confusion as to time, place, personality, increased suggestibility, etc. (*Korsakoff's psychosis*), is of ominous significance. Even if the patient recovers from the neuritis, the prognosis of the mental condition is unfavorable.

INSANITY.

The treatment of the insane along scientific principles is a wide problem that can only be outlined in the space here allotted to it. We are forced, on account of the large and increasing number of cases of mental disease, to segregate not only the hopeless but also the curable cases in asylums where they must necessarily be treated *en masse*. One physician cannot successfully treat hundreds of complex mental cases. The system of mixed institutions, *i. e.*, asylum and hospital combined, does not, as a rule, work out well in practice. The best brain in the institution, a trained psychiatrist selected for his training and experience in

the handling of mental cases, is, as a rule, so overwhelmed with details of management that he is able to devote little time to the treatment of the individual case. The assistant physicians under him are overworked with the routine of history taking, and the general tendency is to segregate cases according to an arbitrary and, for the most part, theoretical classification. Whatever success is obtained in the handling of a mental case must depend upon the careful consideration of all the etiological factors in its causation, a careful psychological analysis of the case from its inception, a detailed study of the condition of all the viscera, with their activity, and the most careful attention to the most minor and major principles of the treatment as applied to the individual. Too much attention has been paid in the past to an attempt to establish clinical groups and to label the case with a name.

In the normal nervous system with good heredity exhaustion of the nervous system is manifested by simple fatigue reactions. With bad heredity, or with a nervous system deficient from birth, or functionally perverted at the critical periods of life, exhaustion of the nervous system either from overstrain, visceral disease, low nutrition, or intoxication often shows itself in some form of mental aberration.

Three problems of treatment need consideration. The prophylaxis of mental disease, the treatment of a curable case, and the care of the hopeless insane. It would appear that a large group of the insane, as we see them in asylums, were doomed from birth either as mental deficiencies or to the development at some time of life of acquired insanity. The more careful analysis and study of this group will, however, show that to a certain extent it may be prevented. The question of the maintenance of the body, and, therefore, of the nervous nutrition at a level well above the symptom point, is an important matter in the prevention of a mental breakdown in such cases. The nutrition must not only be kept well up to the normal, but the education must be so directed as to give a maximum of control with the elimination of emotional variation, and the occupation must be carefully selected to prevent mental stress and nervous waste. In a child of insane stock a highly developed imagination, a faculty of writing poetry, mental dissipation in music or other forms of art should not only not be encouraged, but eliminated as far as possible in the training of the child, and in its place a more balanced and practical routine of education substituted. The danger of sending one of these children through an advanced college education instead of placing him at some practical mechanical or farming occupation is exemplified in the mental breakdown seen in the students in our large universities from year to year.

The question of nutrition can be carried farther than the individual. Low grades of nutrition in the mother from wasting diseases, such as tuberculosis, cancer, etc., is not infrequently seen in states of deficient nutrition, nervous deficiency, and lack of resistance in the progeny. Any wasting disease, and tuberculosis is the most common and widespread, by lowering the nutrition in a susceptible individual below the symptom point, leads not infrequently to the development of mental disease.

Add to this the effect of intoxication from an infectious process, and the results speak for themselves. With refined methods of diagnosis, the influence of syphilis in the production not only of paresis, but of organic dementia and other mental defections becomes evident. Noguchi has recently made the rather startling announcement that 20 per cent. of the cases of adolescent insanity, dementia præcox, show the Wassermann reaction. Certainly, here are two most potent factors in the production of insanity which can and ought to be eliminated. The prevention of tuberculosis, as the duty of the medical profession and also of the State, needs only to be mentioned. Metchnikoff and Roux have demonstrated that, even with illegitimate sexual intercourse existing as a necessary evil, syphilis can be prevented. The elimination of two such factors will unquestionably decrease the incidence of insanity, and the recognition of them as such important factors by the physician will aid materially in the protection of patients coming under his observation for treatment. Postinfectious psychoses, which not infrequently follow typhoid, influenza, etc., can to a certain extent be prevented by relieving the intensity of the intoxication during the course of the disease, and a careful attention to the general nervous health during convalescence. Post-operative psychoses can often be prevented by proper attention to the function of the heart and the kidneys. A persistent low blood pressure will often be the key to violent mental manifestations following operative procedures.

A mental breakdown can often be prevented in neurotics with a bad family history by careful attention to the elimination of all sources of waste of nervous energy, and more particularly preceding the critical periods of life. The preparation for and care during adolescence has already been mentioned; equally careful preparations should be made for the menopause; pelvic disease, uterine displacements, deficient cardiac and kidney action, and intoxication from syphilis, malaria, rheumatism, etc., should all be corrected and the physical condition be brought up to or above the normal, in preparation for this period of nervous stress. We are too prone to consider the period of from forty-five to fifty-five as critical only for women; not infrequently we see in men at this period of life a condition of nervous tension and irritability, mental depression, and a general lowering of working efficiency, which sometimes proceeds to full mental alienation with delusional states. This condition needs careful attention, with the conservation of nervous energy, and once passed the patient is free from further mental disturbance.

The treatment of a case of mental disease begins with a most careful and painstaking history and clinical examination, with the full information as to a possible physical basis for the mental disturbance. The most important question for consideration is that of the advisability of treating the patient at home, in a hospital, or of restricting his liberty at an institution for the insane. This will often depend upon the circumstances of the patient, and will also often depend upon the position of the individual in the community. A man who occupies a high position of trust in a large corporation, or a member of any of the learned professions, will

often be treated outside of an asylum in order to save the reputation of the family, and to save the individual from the stigma of insanity. Relatively few cases of insanity can be permitted to remain with full freedom at home; the only cases in which this is permissible are the mild delusional states without depression, seen in the aged. Practically all other cases require careful observation and proper control. All cases with maniacal outbreaks require asylum treatment, on account of the noise and disturbance of the other patients, either in home or hospitals. I am opposed to treatment of these patients at home, even when proper quarters and skilful attendants can be secured, on account of the stress and emotional drain on other members of the family. Depressed mental states require careful judgment as to how far they indicate the different methods of treatment. Mild cases with physical exhaustion as a basis can often be treated at home without danger. In all cases with suicidal tendencies properly equipped hospitals with trained attendants or insane asylums are indicated. Hospital treatment in the borderland cases with a relatively favorable prognosis is often to be preferred to the commitment to an asylum, on account of the hopeless depression the latter course is likely to produce. Too often, however, a false sympathy and misplaced confidence delays a commitment where threats or attempts at suicide have been made, until it is too late.

The elements of treatment do not differ from those employed in functional nervous disorders; the proper use of rest, exercise, occupation, hydrotherapy, suggestion, etc., requires even more careful adjustment to the needs of the case than in the more simple exhaustion neuroses. Careful nursing is of the utmost importance. Attendants trained in insane asylums rarely have either the brains or the art of handling a complex case. A clever trained nurse with experience in the treatment of neurasthenia, hysteria, and psychasthenia will often prove of great value, even when it is necessary to employ stronger attendants to assist her.

The alimentary functions need careful and constant attention. The nutrition must be kept up to the normal, and overfeeding employed when it is much below the normal. Artificial feeding by means of the stomach or nasal tube should be avoided as long as possible. A nurse with persuasive tact, backed by a firm determination, will often succeed in full-feeding a patient who has resisted all efforts of a less capable or a poorly trained one. Artificial feeding should not be delayed once it becomes necessary. In women patients this can often be effected by the use of a feeding-cup, the nurse holding the nose in order to induce the patient to swallow. If this is not successful, the nasal or the esophageal tube can be employed. The ordinary stomach (esophageal) tube is to be used when possible in preference to the smaller nasal tube. When too much resistance is given to this, the smaller nasal tube may be used, due care being employed to prevent the tube from entering the larynx. The largest tube which can be passed through the nostril should be employed in order to prevent regurgitation around the tube. This method of feeding should, whenever possible, and practically always at the beginning, be under the care of the physician, and should at no time be dele-

gated to inexperienced hands. It is rarely necessary to continue the feeding over, at the most, a few weeks. The process is sufficiently disagreeable to induce the patient to accept food in the ordinary way after a short time. In melancholia, paranoia, etc., where the refusal to take nutrition is based on a delusion, it is necessary to continue the feeding over a longer period of time.

The question of overfeeding has been sufficiently discussed under the consideration of the rest treatment.

In artificial feeding, the diet must necessarily be liquid, and should consist of one or two pints of milk and one or two raw eggs, administered three or four times a day, according to the necessity for feeding.

Careful attention should be given to the condition of the bowels and the elimination of urine. In most cases of mental disease a sluggish condition of the bowels demands the use of mild laxatives, and in some cases, of free purgation. When there is evidence of intestinal fermentation and auto-intoxication, washing out of the lower bowel with large quantities of salt solution is indicated. Simple enemata of soap and water will often be found useful in removing masses of impacted feces. Great benefit has been claimed from the use of intestinal antiseptics in mental states. They are, of course, only of value in the cases of auto-intoxication above referred to. A daily report should be made as to the elimination of urine and the daily quantity for twenty-four hours; in this way the activity of the kidney-function can be measured and retention of the urine detected.

The value of rest in the exhaustion group of cases has already been discussed. It is rarely advisable, however, to put these cases on the full rest treatment. In the depressive cases it has, as a rule, a deleterious effect; in the maniacal group of cases too strenuous attempts in securing rest in bed often leads to more exhaustion than in permitting the patient a certain amount of freedom. For this reason restraining measures should be used only when absolutely necessary. Free and active purgatives and the use of sedatives, such as chloral, hyoscine, etc., will often avoid the necessity for such measures. The continuous hot bath will be found a valuable adjunct when the means for carrying it out thoroughly are at the disposal of the physician.

Next in importance to rest, and closely associated with it, is the question of sleep. This is needed not only in the excited, but in the depressive groups. The general tendency is to abuse the use of hypnotics. If there is no respiratory or cardiac complication, chloral in doses of from ten to fifteen grains, with from twenty to thirty grains of bromide of soda and a hot bath of from twenty to thirty minutes, will often be found sufficient to secure sleep, even in the maniacal cases. Trional will often be found to be of value, and will often be preferred to sulphonal, veronal, etc. General rules with regard to the use of hypnotics, which will be found in the chapter on Insomnia, apply equally to the mental cases. Too much importance cannot be attributed to the disturbances of the gastro-intestinal tract in the production of disturbances of sleep. In the depressive group and often in those in which suspicion is the

dominant symptom, an alcoholic stimulant, such as milk punch or a bottle of beer, will be found to be more efficacious than sedative drugs. In the melancholias in which physical and psychic pain are present, opium or one of its preparations will be found necessary. During its administration the bowels should be kept carefully opened and the activities of the kidneys carefully watched. This, like all other hypnotics, should be reduced in dosage and finally eliminated as early as possible. Exercise and the employment of the mind becomes an important matter throughout the course of the milder depressive and delusional mental states and during convalescence from the more active and excitable mental conditions. If sufficient outdoor exercise cannot be obtained, massage and electricity are indicated; the latter must be used with great caution in cases in which delusional states may be fixed by apprehension of its use. Massage gives the best results in the cases showing mental depression. The application of all these various means must naturally depend on the indication in the particular case. Two main symptom groups require detail consideration—the treatment of excitement and that of depression. While either of these may occur in any form of mental disease, they are typified in the manic-depressive group, commonly known as mania and melancholia.

Mania.—The treatment of acute mania must necessarily follow sedative lines. The patient should be removed from home to quiet surroundings in a well-ordered hospital or sanatorium. All forms of irritation, both mental and physical, should as far as possible be eliminated. If the patient presents a condition of violent excitement, free or even profuse purgation should be established and proper feeding instituted. These two measures will be found to be of more benefit than drug medication in producing a quiet atmosphere. Full doses of bromide and chloral with trional at night will assist in producing sleep. Opium is rarely of value, and usually produces untoward effects. It is, as a rule, in mania contraindicated. The prolonged hot bath has a distinctly sedative effect. It should be employed at the time of retiring. Rapid emaciation and exhaustion is likely to occur if close attention is not given to proper feeding. If this is secured, motor excitement need not be too closely considered. It is, indeed, often advisable to permit a certain amount of freedom of motion, and in this way to secure proper exercise. It should not, however, be permitted to go on to exhaustion. The same may be said of mechanical restraint; if the patient chafes under it with persistent constant attempts at its removal, it is better to secure the service of one or two attendants who will be better able to enforce the proper amount of quiet by firm but gentle measures. Milder forms of mania, so-called hypomania, are not infrequently exhaustion psychoses, and require a modified form of rest treatment.

Melancholia.—The treatment of melancholia depends entirely upon the type of the disease and the degree of depression. In the milder forms home-treatment with proper care will often be found sufficient; when, however, an acute melancholia is well established, a hospital or sanatorium is indicated. If the patient is kept at home, it is necessary

to confine him to a single room with the closest kind of observation, on account of the danger of suicide. The same attention to alimentation, as above noted, must be given. The patients frequently refuse food, and require artificial feeding. When the tongue is coated, it is often advisable to wash out the stomach preceding the introduction of food. I find that the patients under my observation will react more promptly and the mental condition will clear up more rapidly if the patient is treated during the entire time in the open air, and, indeed, it has been my custom during recent years to treat all acute forms of insanity as far as possible in the open air; by this I mean, of course, the keeping of windows and doors communicating with the outside air open during the winter months. This does not necessarily mean a non-heated air, because the ordinary heated air is kept turned on and modifies the air to such an extent as to make it bearable. The general nutrition should be kept up to the normal and stimulant tonics administered, more particularly when the blood pressure is low. When the suffering is intense, the opium treatment must be used, but should be carefully watched. The deodorized tincture should be begun in small doses and increased up to forty or fifty minims, three times a day. There does not appear to be in these cases the same tendency as in an ordinary non-mental case to the production of a habit. If the case is properly selected for its use, it not only may not produce constipation, but on the contrary may have a distinctly laxative effect; in improperly selected cases it will often produce periods of excitement, or often increase the depression.

Dementia Præcox.—The prognosis of dementia præcox has been given at from 50 to 90 per cent. of cases progressing to a chronic dementia. From a therapeutic standpoint two groups of cases need to be distinctly differentiated. The first of these embraces a large group of cases with delusions centred for the most part about the sexual life, and which are, as a rule, unfavorable from their onset. In the second group the mental breakdown develops rather early, from the seventeenth to the twenty-first year, as the result of emotional or educational overstrain. This group requires careful treatment; in many of the cases the restitution of the mental health may be secured in from six weeks to three months. Even, however, when this favorable result obtains, a second and more serious mental break may be expected if exceptional stress or strain is thrown on the individual at some later period. Not infrequently, in young women, a preliminary disturbance is noted from sixteen to eighteen, and a more serious break about thirty. When a second mental breakdown occurs, it is of more serious consequence, and usually with a more unfavorable prognosis.

A mental disturbance early in life, giving the picture of dementia præcox, needs careful treatment and exceptional care and protection of the individual in after life if a successful result is to be obtained. I think it is a mistake to place these cases in an asylum under unfavorable surroundings until the nature of the case has been determined. The mental stress of confinement, the unfavorable effect of other mental cases, may have a deleterious influence and may change the prognosis

of an otherwise favorable case. In young women in whom exhaustion plays an important role, it has been my custom to place these cases on a modified rest treatment, to which is added some congenial occupation, in a proper hospital, sanatorium, or rest-house. As soon as the patient is properly rested and the mental atmosphere is relatively clear, the patient is sent with a proper nurse for a period of travel, or to a sea-shore resort with facilities for some but not too much mental diversion. The same treatment is carried out in young men who need bed treatment, or those who need to be kept under careful observation, or those who need partial rest. If the case is seen sufficiently early, or in cases after proper rest has been secured, farm life offers the ideal occupation. There ought to be no responsibility, and the patient ought to be kept occupied with light work for several hours a day. A period of mid-day rest may or may not be advisable; in some cases the patient is required to rest in bed; in other cases this period may be spent in some congenial exercise, such as tennis, cards, fishing, etc. In some cases the day is divided up into a period of morning work, a period of mid-day rest, with the afternoon free for one of the above forms of relaxation. In some cases in which the work is congenial to the patient, and when he is able to stand the physical strain, regular farm work, the patient working the full day with the other hands, is permitted. It is quite necessary, in any event, that the patient should be under careful observation. In some cases this can be obtained by having a companion, a friend of the patient, working at the same place during the first month or two. In other cases the farmer, if he be a man of discernment and sufficiently interested, will be able to give what little attention is necessary. I have often found it most convenient to have a relative, a sister or a brother, a father or a mother, to act the part of companion and observer during at least a part of the treatment; they, at least, have a knowledge of the normal condition of the individual, and would be able to detect unfavorable symptoms much sooner than a stranger.

I am not in favor of a farm colony for mental and nervous patients. It will, however, sometimes be necessary to use it in spite of the unfavorable influence of other nervous patients, and the playing at work rather than the doing of real, purposive work. The cases must be properly selected, and must be free from suicidal tendency. The case ought to be examined by the physician at periodic intervals, the details of the life of the patient carefully inquired into, unfavorable conditions remedied, and proper encouragement supplied. The length of time necessary for the patient to remain under this treatment will depend entirely upon the case. Six months to a year is the time usually prescribed, although in some cases the patient shows enough interest to take up farm life as a livelihood and usually with good mental results. If the patient returns to the complex life of the city, the occupation must be carefully selected with the idea of relief from responsibility, protection from overwork, or sudden emotional or mental strain. If farm life is not advisable, a long period of travel with a companion or with a physician may be prescribed, or several months of permanent life in the woods substituted.

A small proportion of these cases coming under my observation show a slightly active or previously healed pulmonary tuberculosis. In such cases the weight should be brought up to the normal. It is a mistake, however, to place a patient with a slightly active pulmonary lesion on the routine sanatorium treatment for tuberculosis. The disease must, of course, be treated along the lines of hypernutrition in the open air, but not so extensively as in tuberculosis; the knowledge of the existence of such conditions on the part of the patient would produce the worry and the nerve strain which we are seeking to avoid.

Berkley advocates the removal of a portion of the thyroid gland in carefully selected cases, with symptoms of hyperthyroidism. I have not had any experience with this method of treatment, and am not able personally to speak of the value of it. Berkley, however, claims a cure in five of eight cases in which approximately four-fifths of one lobe of the thyroid gland was removed without injury to the parathyroids. These good results have not been attained by other observers.

Paresis; General Paralysis of the Insane.—This disease, once looked upon as absolutely hopeless as soon as the diagnosis was made, is sometimes successfully treated on the assumption of the basis of syphilis. This treatment must be carefully carried out. In apparently true cases of paresis the results must remain inconclusive, on account of the difficulty in being absolutely certain as to the diagnosis. Paradiamidodioxarsenobenzoledihydrochloride ("606") has been used in a few cases, without, however, showing positive results. A wider experience may show it to be of some value in incipient cases.

It is certainly true that often it is impossible to differentiate between cerebral syphilis and paresis. It has been my policy to place every case of early paresis upon thorough antisiphilitic treatment. If it does no good, it at least does so little harm, that it may be disregarded in the hopelessly unfavorable group of cases. Every case of paresis, once definitely diagnosed, should be under careful observation and restraint; in the vast majority of cases, if not in all, asylum treatment is advisable.

OCCUPATION NEUROSES AND POISONINGS IN THE ARTS AND BY FOODS

By JAMES HENDRIE LLOYD, M.D.

THE OCCUPATION NEUROSES.

By a *neurosis* is understood an affection of the nervous system in which the pathology is not marked by conspicuous organic changes; in other words, it is what is generally called a *functional* disorder. This view should not be lost sight of in considering the therapeutics of these affections, although it is easy to fall into the error of regarding a nervous disease as functional merely from the fact that its pathology is unknown, or that it depends upon such slight organic changes that these can be ignored. In fact, all function depends upon structure, and this is an important truth in considering the therapeutics of the neuroses as well as of well-recognized organic diseases.

By the *occupation* neuroses is understood a class of nervous disorders caused by the overuse, in various regions, of the neuromuscular apparatus in the work of some trade or avocation.

The commonest of these affections are scrivener's palsy, telegrapher's cramp, and piano-player's hand; but similar disorders, although more rare, are seen in blacksmiths, bricklayers, tailors, violin-players, cigarette rollers, typesetters, and engravers. A curious form is sometimes seen in milkers, and was first described among the cow herds in the Tyrol; it is also seen in this country. In all the above instances the affection is located in the hand or arm, or both; but cases occur in which the neuromuscular apparatus in other regions suffers. Thus, the disease known as clergyman's sore throat is largely a neurosis, a disorder of the muscles of speech, and is not confined to clergymen, but is seen in other professional voice-users, such as singers. A very odd form of the occupation neuroses is miner's nystagmus, in which the small muscles of the orbit are involved.

The most familiar of all these affections is *scrivener's palsy*, also called writer's cramp. It occurs in persons who have to do long-continued writing, and in this age of the typewriter it is probably decreasing in frequency. The chief symptoms are spasm, tremor, and incoördination; pain is occasional; vasomotor disorder is rare; and true paralysis and anesthesia are almost unknown.

The spasm occurs, as a rule, only on attempts at writing, and is present especially in the muscles moving the fingers, wrist, and forearm; occasionally, however, it extends to more distant muscles, as those of the

shoulder and neck, and even of the foot and leg. It is not a cramp, for it is painless. It may persist for some moments after the attempt at writing has ceased. Tremor and incoördination are sometimes seen. True paralysis is not seen, although a slight paresis, from fatigue, is not unusual. Anesthesia is not present, except as an occasional hysterical complication. Pain, or a painful sense of fatigue, is sometimes experienced, and there may be painful points on pressure. Among other and more rare symptoms are neuralgic pains, vasomotor disorders, such as flushing and swelling, and slight muscular atrophy.

In *telegrapher's cramp* the symptoms are similar to, if not identical with, those seen in scrivener's palsy. In a series of cases which I once studied and reported the element of spasm was the most marked. The operator's hand would be held for a few moments as in a vise, and thus drawn forcibly away from the key. Fulton estimated that an operator on the Morse instrument makes between thirty and forty thousand movements an hour. It is the effort required in making a rapid succession of small strokes and dots that finally throws the muscles into a tetanic spasm. Some of these operators are addicted to the use of tobacco and alcohol, and they worry about their disorder, and thus induce a condition of neurasthenia which greatly embarrasses the treatment.

In *piano-player's hand*, as I have seen it, the symptoms are pain and fatigue rather than spasm. In one young woman the painful points were at the small joints of the fingers, and especially at the metacarpophalangeal joints, and were probably due to overstretching the parts in the efforts to span an octave. Prolonged practice on the piano, sometimes for hours at a time, is the cause. Spasm is reported by some observers.

It is not necessary to describe in detail the other occupation neuroses of the hand and arm, such as may occur in blacksmiths, engravers, and other artisans. They are practically the same as those described above, except that the affected muscles vary according to use.

Treatment.—The treatment for writer's cramp is prophylactic and curative. It is applicable to all these affections.

Unfortunately prevention is not always a practical question with a physician, because the patient usually does not seek advice until after the harm is done. The important rule, of course, is moderation in work; those persons who have to do much writing should guard against overwork, and should systematize their hours of toil and rest. Certain mechanical devices are recommended, but first in importance probably is the stub pen. This form of pen gives a firmer support to the hand and does not require such a fine muscular adjustment as the pointed pen. The large penholder has also been much lauded; some of these are of immense size, made of cork for lightness, and they act beneficially by relieving the cramp-like grasp necessary for holding a slimmer one; in other words, they substitute a slightly different muscular action for the one at fault. Some writers learn these facts by experience, and devise various monstrous or unique penholders to suit themselves. A soft rubber cover for the penholder is claimed to act well by relieving the

grasp of the overwrought muscles. All these devices unfortunately are but makeshifts if the abuse of the muscles is continued. The same may be said of the various directions for holding the pen at a certain angle to the paper, or for grasping the pen in unusual ways, as between the front and middle fingers. They fail either to prevent or to cure if the abuse is continued.

From what has just been said it follows that rest is the most important remedy for the cure of these affections. Without rest nothing can be done. By rest is not meant so much absolute rest as abstinence from writing; hence, the use of the hand for other purposes need not entirely be interdicted in all cases. In this matter, however, much depends upon circumstances. Absolute rest may be needed for a few weeks in severe cases. The exact amount must be left to the judgment of the practitioner. Solly's dictum that two months is sufficient to cure any case is misleading. Some cases require more, some less. Unfortunately, as these victims usually have to earn their living by the use of the pen, complete and prolonged abstinence is often impossible. Half-way measures, however, are not satisfactory from either the commercial or the therapeutic standpoint. It is better, therefore, for the patient to give up entirely for several weeks, and then to return cautiously to work. In most cases the attempt to resume a full routine of work quickly causes a relapse, the first signs of which should be a warning to desist.

The education of the other hand has been tried with a measure of success, but opinion seems nearly unanimous that the onset of the disorder in this hand is only a matter of short time if overwork is done. It is said that the victim of telegrapher's cramp is very prone to acquire scrivener's palsy, although, as a rule, the victim of an occupation neurosis has good use of his hand for any other purpose, showing how it is a particular associated movement that is affected.

Resort should be had to the typewriter when possible, but the fact should not be overlooked that even this change of instrument, if the instrument is abused, may cause practically the same trouble.

Along with rest or abstinence other means are to be tried. Gymnastics and massage, according to the method of Wolf, may be used. This consists in rubbing, kneading, tapping, and exercising the muscles both by active and passive movements. This treatment should be given once a day by a trained masseur, care being observed not to overdo it, and thus weary the muscles. Very light exercise with dumb-bells or Indian clubs may be used later, for it seems that a *change* of motion acts beneficially by diverting, as it were, the activity of the muscles into a different channel.

In case the arm is sensitive or painful, the process of baking should be tried a few times; the first treatment or two should be continued but for a few minutes, in order to try the effect; if they are soothing and beneficial, the séance may be prolonged.

Electricity has been much used, but its use requires caution. In case the arm is sore and irritable, the faradic current may do harm. Electro-irritability is sometimes increased in these affected muscles,

and this contraindicates the use of faradism, which would only still further tire the muscles out. I have always thought galvanism a better remedy, as it can be used without shocking the muscles. It should be applied by stroking with a wet sponge, the anode pole being applied. Its use is better deferred until later in the treatment, after the arm has been thoroughly rested for a few weeks.

It should be borne in mind that in many of these patients a general condition of neurasthenia is present; in other words, there is more than a mere local affection. Treatment, therefore, should be directed to this general state. In severe cases, especially in women, a period of rest cure in bed for several weeks may be indicated. This should be accompanied with forced feeding, general massage, bathing, and tonics. Even though this absolute rest cure is not required, a modification of it may be tried, always with attention to nutrition, hydrotherapy, and tonic drugs. A daily bath, even a shower bath, should be given by a nurse. The local wet pack, *i. e.*, alternate hot and cold swathing of the arm, is recommended in the early stage.

The use of alcohol and tobacco should be forbidden. In telegraphers this seems especially important. I was informed by an official of a large company that in his belief some of these operators resort to alcohol in a vain attempt to keep up with their work. The result, of course, is disastrous.

The use of drugs in any of the occupation neuroses is but limited. There is no specific for these affections. Tonics are, of course, indicated on general principles. Quinine, iron, strychnine, and the bitter tonics are the chief of these. Some observers have recommended the hypodermic use of strychnine in the affected muscles; this is said not to be contraindicated by the fact that the muscles are hyperexcitable, provided the patient abstains entirely from his work. Personally, I have had no experience with it in these disorders. Sedative and depressive drugs are absolutely contraindicated. The whole list of opiates; bromides, chloral, belladonna, and the coal-tar products is named here only to be condemned. Opium in any form is especially a dangerous drug, from the risk of the patient forming the habit. The aim should be to build up, not to pull down. If the muscles are the seat of pain, this will soon subside with abstinence and rest.

The grave question always presents itself whether the patient should give up his work permanently. In view of the tendency of the disorder to return, and to induce a severe state of neurasthenia or hypochondria, which might disable the patient for a long period for any useful employment whatever, this question should be fully discussed by the physician. It is better to turn to something else, before it is too late, than to run the risk of still more serious disablement.

The treatment for telegrapher's cramp, piano-player's hand, and the other occupation neuroses is not different from that advised for scrivener's palsy; hence it is not necessary to repeat here a line of treatment for each and every form of these disorders. Someone has recommended that telegraphers should use a very large key, something like a

door-knob, taking the hint from the giant penholders used by scribes, but I doubt whether it would be more than a makeshift. Piano-players, especially women, are likely to present neurasthenic and hysterical symptoms, and these should be combated with appropriate and suggestive treatment.

Clergyman's sore throat, so called, may be taken as a type of the occupation neuroses seen in professional voice-users. It is not so much a genuine sore throat as a disorder of the neuromuscular apparatus of the throat and larynx. In some cases, however, there is an element of pharyngitis or laryngitis. The neurotic element, nevertheless, is the important one, and some of these cases are distinctly hysterical, the resemblance to hysterical aphonia being complete. Mackenzie relates the case of a fish-hawker, who suddenly lost his voice while crying his wares, and did not recover it for some months. Just as in scrivener's palsy, the muscles in some cases are affected only for the particular function; thus, a public singer broke down in the midst of her song and could not utter another note, and yet her voice remained perfect for ordinary speech.

Fränkel has divided these cases into three types—the spasmodic, the tremulous, and the paralytic—but this is probably a needless refinement.

The treatment is by rest, abstinence from the use of the voice, tonics, massage, hydrotherapy, electricity to the muscles of the throat, change of scene, and, in case of any local catarrh, appropriate local treatment. Suggestive treatment is important in cases in which there is an hysterical element; in fact, some of the remedies most highly lauded, such as massaging the muscles of the neck, and applying electricity within the throat, probably act by suggestion. Cocaine to the throat should never be used for or by these patients.

Miner's Nystagmus.—This affection must be placed among the occupation neuroses. It has been especially well described by Snell,¹ according to whom it is caused by the constrained position of the eyes while the miner is at work. During his work the miner lies on his side, with his eyes directed obliquely upward. The ocular muscles are thus put upon a constant strain, and this strain causes a fatigue neurosis, which is shown in an oscillation of the eyeballs.

The nystagmus is present especially when the eyeballs are rolled into the position occupied during the work, hence when they are rolled obliquely upward or even above the horizontal plane. Snell says that the movements are chiefly rotary, but to-and-fro oscillations are also seen. Tremors of the head, of the muscles of the face and neck, and of the eyelids are observed in some cases. Vertigo and headache may complicate the trouble. Wry-neck is occasionally present. As many as 20 per cent. of miners are reported to be affected in some mines. Snell found about 5 per cent. He has also observed the affection in other workmen whose work required a forced position of the eyes.

¹ Trans. Ophthalmolog. Soc. of United Kingdom, iv, 315, and in a later paper in Oliver's *Dangerous Trades*, p. 761. See also *Diseases of Occupations*, Twentieth Century Practice, vol. iii.

Treatment.—Obviously the chief remedy is rest for the affected muscles, and this can only be secured by desisting from the work or by changing the occupation; but this latter is not easily done by men who depend upon their labor for their bread. Drugs cannot avail so long as the cause continues to act.

From the reports of cases it seems that this affection is grave enough sometimes to interfere with work. Doubtless the vertigo and headache contribute to this disablement. An element of neurasthenia is also present, and anemia is common among miners. It follows that a good tonic and dietary treatment are important. Iron in some form should be given, along with highly nutritious food. Strychnine is to be recommended, and caffeine is to be given for the headache. Electricity should be used, if at all, with great caution about the eyes.

POISONING IN THE ARTS AND BY FOODS.

In considering the treatment of these affections it will be necessary, in order to avoid repetition, to group them. Thus, each particular poison will be considered in a section by itself. A poison acts practically in the same way, however it may gain access to the system; but its modes of gaining access may be very numerous, owing to the wide and varied use of the poisonous material in the arts. In the case of lead, for instance, there are so many ways in which it is used, and so many technical and intricate processes, that it is obviously impossible, just as it is undesirable, to describe them all in detail in such a work as this.

Lead.—Of all the mineral poisons, lead is doubtless the most widely used in the arts. According to Oliver¹ there are few articles of manufacture that are not at some time directly or indirectly brought into contact with lead, and in many of the newer industries the association is extremely close. The English census of 1891 showed that there were 132,010 persons employed in lead processes. The majority of these were painters, workers in leaden goods, and lead miners. In America the number is probably as relatively large. In Philadelphia my own experience in hospital practice has led me to believe that the commonest sources of the poisoning are the manufacture of white lead and the use of lead paints by house-painters. Lead is found in nature as galena, which is a sulphide of the metal, and is the commonest lead ore in Europe. In this country a carbonate of lead, rich also in silver, is found, especially in Nevada and Colorado, and is worked both for the silver and the lead. In smelting galena, which is done by roasting, a heavy "lead smoke" is emitted, which is the source of poisoning. Miners of galena, which is very insoluble, are said not to be so much affected as the smelters.

¹ *Dangerous Trades*, p. 282. I wish to acknowledge here my obligation to Dr. Thomas Oliver's valuable book in preparing this article. I have also made frequent reference to my former and more extensive work on the *Diseases of Occupations* in the *Twentieth Century Practice*, vol. iii.

Among other workers who are exposed to lead are the makers of lead pipes, shotmakers, typefounders, typesetters, toymakers, plumbers, gilders, lacemakers, glasscutters, makers of artificial flowers, enamel glazers, potters, and filecutters. There are many others in the various arts too numerous to be mentioned.

Owing to the increased demands for hygiene and prevention, lead poisoning in the arts is probably less common than it once was. Manufacturers have found that it both pays and is necessary to adopt precautions. The means adopted vary with the methods and details of the particular trade or manufacture, and are often technical and intricate. They belong rather to hygiene than to therapeutics, and cannot be described here.

Lead poisoning by means of food and drink is by no means uncommon. The name "*colica pictonum*," which is still in use, was derived from an epidemic in Poitou in the seventeenth century, caused by the adulteration of wine with lead in order to correct acidity. In the cider-making districts of England the "*Devonshire colic*" is caused by the contamination of cider from lead vessels. The contamination of drinking water from lead pipes has been known, but is now probably rare. Beer and ale have been contaminated in the same way. In Philadelphia some years ago D. D. Stewart reported a series of cases of poisoning caused by the chromate of lead which some bakers had used to give color to their cakes and biscuits. Red lead was formerly used as an adulterant of cayenne pepper. Cheese, contaminated from a metallic wrapper, has caused lead poisoning. Among other sources of poisoning are canned foods, soda water, milk, Jamaica rum, old painted wood used as fuel for roasting meats, glazed earthenware, and flour. There are doubtless others, but these are sufficient to show how widespread and various these sources are. The case of baking flour illustrates how unlooked for the sources of lead poisoning may be, for the metal gains entrance to the flour from lead used by the millers to plug holes in the grinding stones. Citric acid, tartaric acid, and cream of tartar may contain lead derived from the pans in which they are prepared.¹

Allied to such cases, although not caused by means of food, is the case of a sempstress who was poisoned by biting off the ends of thread which had been weighted with lead. Lead poisoning has also been caused by contaminated snuff, by cosmetics, and by hair dye; and it has been traced to the practice of cleaning bottles and decanters with the aid of shot.

Symptoms.—Lead causes acute and chronic symptoms. Acute lead poisoning causes a sweetish taste, pain in the stomach and bowels, vomiting, thirst, constipation, sometimes diarrhea, various forms of paralysis, anesthesia, cramps in the limbs, and collapse. The first matter vomited is usually white or curd-like from the presence of chloride of lead. The stools are blackened by the sulphuret of the metal. Convulsions and coma occur occasionally. This acute form is usually

¹ Thresh and Porter, *Preservatives in Food*, p. 202.

caused by the ingestion of a large quantity of the poison at once or in a brief period, and is not common in poisoning in the arts.

Chronic lead poisoning is the form usually seen among artisans, and also in many of the cases caused by contaminated food, in which the victim is affected gradually by taking small and repeated quantities. It is marked by anemia, colic, epigastric and precordial pain, vomiting, constipation, a blue line on the gums, paralysis, such as wrist-drop and other symptoms of a multiple neuritis, ataxia, tremor, anesthesia, arthralgia, muscular pains and cramps, and optic neuritis, or atrophy. More rare is the encephalopathy, in which there are convulsions, delirium, and coma. Contracted kidneys and the general symptoms of the so-called "lead gout" may be added. Muscular atrophy is occasionally seen. Hysterical and neurasthenic symptoms are present in some cases.

Treatment.—In acute poisoning the first thing to do is to wash out the stomach. The sulphates of magnesium and sodium act as antidotes by forming sulphate of the metal, and therefore Epsom or Glauber's salt should be given freely; any excess of the salt acts as a purgative and thus promotes elimination. Dilute sulphuric acid is also an antidote. To allay pain, albuminous and mucilaginous drinks should be given, and opium or some of its derivatives may be needed. Warm poultices or fomentations to the abdomen tend to relieve pain. Many years ago Norris, an English physician, who saw an epidemic of lead poisoning caused by the accidental contamination of baking flour with acetate of lead, had good results from warm baths, which relaxed spasm and relieved abdominal pain.

In chronic lead poisoning the first indication is to remove the cause. This subject of prevention in all the industrial poisonings is a very wide one, because, as already said, it often involves various alterations in the details of some manufacturing process. It therefore cannot be discussed here. The most that the physician can do is to point out the evil, and to insist that radical measures be taken whenever possible. To the credit of manufacturers and health officers it must be said that great improvements have taken place all over the civilized world, and lead poisoning is doubtless much less frequent relatively than it otherwise would be. The physician should also know that some of the difficulties in prophylaxis arise from the ignorance and stubbornness of the workmen themselves. It is extraordinary what risks some of these men will take, and how obstinately they will oppose every means taken for their protection. A workman in a white-lead factory, who worked in a very dusty and dangerous place, refused to wear a mouth protector because it interfered with his chewing tobacco. When the first advance was made toward improving the insanitary state of the Sheffield grinders the men opposed it, as they believed it was a scheme to lower their wages. The more danger, the more pay. In my own experience it has not been unusual to find workmen who rather belittled the dangers, and who evidently could not be relied upon to exercise much precaution. The most important preventive of all in dusty factories is ventilation, and this is now generally effected with care by means of rotary fans.

Lead gains access to the system mostly by the alimentary canal; even when inhaled as dust it is probably by becoming mixed with the saliva and swallowed that it is taken in. Hence, also, the necessity for personal cleanliness, especially of the hands, before taking food. This applies particularly to painters. Mouth protectors of various kinds are used in factories where there is much dust. They are so made that the respired air passes through a sponge moistened with a dilute acid, especially sulphuric. They are doubtless awkward affairs, and, as already said, the men object to them.

There is no true antidote for lead when taken in repeated small doses. A popular notion has long prevailed among workmen that fatty food is a preventive. In Derbyshire such food, especially butter, has this reputation among the miners, and in Philadelphia I have been told by a prominent white-lead manufacturer that in his belief the daily use of milk is important. The value of such food is doubtless greatly overestimated. It could only act by forming an insoluble compound of lead in the stomach. The use of a so-called sulphuric acid lemonade has more to recommend it, but the habitual use of such a drink is not to be looked for among workmen.

For the curative treatment of chronic lead poisoning we are limited to a few drugs. Sulphuric acid is not so efficacious as in acute poisoning, because the poison has been absorbed and the damage has been done. This acid acts probably on the lead only in the alimentary canal and not on that which has been absorbed into the tissues. Nevertheless, it should be used to neutralize any lead that may remain in the stomach and bowels. Glauber or Epsom salt is the best form, as it not only combats the poison, but it overcomes the constipation which is common. A sulphuric-acid lemonade may also be given.

Iodide of potassium has long been used in these cases. Guillot, in 1849, recommended it in a paper before the Académie des Sciences. It is supposed to form a soluble compound with lead in the tissues and thus to favor its elimination, especially by the kidneys. Wood says that the elimination by the kidneys is much promoted in this way. It has even been claimed that large doses of the iodides act injuriously by setting free too large quantities of the lead and thus inducing symptoms of acute poisoning. I have never seen this effect. Moderate doses, of from 5 to 10 grains, three times a day, are sufficient.

Alum is said to act favorably, but in what manner is not known. Large doses, even as high as 60 grains, four or five times a day, are mentioned by some authorities. Others use it in smaller doses. I have never seen any marked effects from its use.

Baths of various kinds are beneficial to relieve such symptoms as pain and cramp.

A bath of sulphuret of potassium is said to promote elimination, 7 ounces of the salt to the bath being employed. Galvanic baths also, and even merely warm baths, may be used, the former for their effect upon paralyzed muscles, the latter for pain.

Various active cathartics, such as croton oil, senna, jalap, and calomel,

have been advised, but my own preference is for Glauber or Epsom salt, for the reasons already given.

Opium may be called for in cases in which abdominal pain is severe, and may be given with cathartics, but its use in chronic cases demands caution, because of the risk of inducing the habit.

Strychnine is highly recommended by some authorities in the treatment of lead palsy. Wood claims that it is extraordinarily efficacious in the anterior poliomyelitis sometimes seen in these cases, and even advises that the drug be pushed to the verge of poisoning. In cases of wrist-drop, which evidently depends upon a local action of lead on the nerve trunks, I have often been disappointed in its use; this is so especially in advanced cases. It should, however, be given a thorough trial. My preference is for the hypodermic use of the drug into the affected muscles, or under the skin overlying them. If this treatment cannot be given with frequency and regularity, the drug should be given by mouth, three times a day, in doses of from $\frac{1}{20}$ to $\frac{1}{30}$ gr.; or the two modes of administration may be combined.

Electricity is also a favorite remedy. In most of these cases the faradic contractility of the paralyzed muscles is abolished; hence, faradism is without value. The galvanic current should be used, and the strength should be proportioned to the reaction of the muscles. Although the reactions of degeneration are usually present, I do not think the poles need be applied with reference so much to that fact as to obtaining a mild response and exercise of the muscles, which can best be done by the alternating current. The muscles should be stroked gently with the sponge as the current is applied. Very strong broken currents are contraindicated. Massaging the muscles with cocoa butter is beneficial.

General tonic treatment and good diet are, of course, indispensable. Anemia is often found in chronic lead poisoning and calls for the use of iron. In view of the fact that contracted kidneys are sometimes present in these cases, I have thought that iron in the form of Basham's mixture, largely diluted, in doses of 2 fluidrams, three times a day, is indicated.

Lead palsy is often an intractable affection, and requires time and patience. The question of the workman giving up his work is sometimes an urgent one. My custom has been to advise these patients that the affection will return if they expose themselves again, and that some other occupation will be better for them; but too frequently their necessities drive them back. When the symptoms of chronic poisoning are mild, and do not include paralysis, the victim, as soon as he is relieved, is apt to think that he is in a sense immune, and that he can return to work with a degree of impunity; but this is not so. There is no immunity, and a blue line on the gums should always be regarded as a danger signal.

In lead encephalopathy the patient is delirious, even comatose, and has convulsions. These cases may be complicated with contracted kidneys, and, in fact, the symptoms may be largely due to uremia. The indications are to promote elimination, and this is done with active purgatives, especially croton oil, or, if the patient can swallow, with concentrated solution of Epsom salt; also diuretics and hot packs.

Hypodermoclysis, with normal salt solution, may do good, and a moderate bleeding may be used along with it, especially if there is high arterial tension. Hare recommends pilocarpine. The bromides are not safe when the tendency to coma is marked.

Arsenic.—Arsenic is found in various ores, the chief of which is the arsenical pyrites. It also occurs in tin, copper, cobalt, and nickel ores. Commercially the white arsenic, or arsenous acid, is the form of the metal most used. The principal danger to workmen seems to arise from the process of smelting or roasting. Precautions are commonly taken, however, and it appears that smelters seldom suffer in well-kept establishments.¹ It is said that dust from the arsenide of cobalt, when drawn into the lungs, causes cancer of those organs, and that this disease is not uncommon among miners in Saxony.²

The two arsenical salts of copper, known as Scheele's green and Vienna green, form beautiful pigments, and are much used. Their principal use is for coloring wall paper, wrapping paper, toys, and artificial flowers. Grinding Vienna or Schweinfurt green is said to be a dangerous occupation.

The testimony as to poisoning from wall paper is somewhat conflicting. Such cases are seldom heard of now, but instances were formerly reported. Among the victims were not only paperhangers, but also the occupants of the rooms thus papered. Paperhangers were said to suffer especially from scraping old paper off the walls.

The coloring of artificial flowers was formerly a dangerous trade. The pigment, Scheele's green, was dusted on the flowers from a dredging box, the work being usually done by women and children. It is claimed that this pigment is not so much used in this work now as formerly.

Arsenical aniline dyes are used to color a great variety of goods, and may be a source of danger both to the workman and to others. Thus, an epidemic of arsenical poisoning from dress-goods in an infant asylum was reported by Putnam. Even playing-cards have been accused. These various processes are liable to change and improvements, so what was once true of them does not always remain true. Carr is to be credited for doing much to lessen these dangers and abuses. It is said that if the process is properly carried out no arsenic passes into the finished aniline dyes.

Soaps, wafers, and candies have been colored with arsenical preparations. Malcolm Morris has given a long list of objects thus colored, which a committee of the London Medical Society made up some years ago.³ This list includes the greatest variety of objects; in fact, there seems to be almost no limit to the use of arsenical coloring matters. Taxidermists are exposed from the use of a preserving material containing arsenic; also anatomists.

Arseniuretted hydrogen sometimes causes poisoning. It is encountered in the gas used for filling balloons. The hydrogen gas is made

¹ Twentieth Century Practice, iii, 342.

² Oliver, *Dangerous Trades*, p. 538, article by Louis.

³ *Ibid.*, p. 378.

from the action of sulphuric acid upon zinc, the arsenic being present in both the zinc and the acid. The plating of lamps with a mixture of hydrochloric acid, zinc, and arsenic has also caused this form of poisoning.

Poisoning from arsenic in foods is not common. I do not include here the criminal cases. Arsenic may be accidentally introduced into foods in various ways, but the scope of this article does not include mere accidental cases, but rather those cases in which the poison gains entrance by some fault in the preparation of food. Passing mention may be made of poisoning from insecticides and parasiticides, and from lotions and ointments; also from the therapeutic use of Fowler's solution, as in chorea and various skin eruptions.

One of the chief means by which arsenic gains entrance into food-stuffs and beverages is sulphuric acid. This acid when made from certain pyrites always contains arsenic, and unless dearsenicated, it is dangerous. It is used in the preparation of various foods, and especially to convert starch into glucose and cane sugar into "invert" sugar. In 1900 a widespread epidemic of arsenical poisoning occurred in and around Manchester, England, which was caused by the use of contaminated glucose in the brewing of beer. More than 6000 cases are said to have occurred, and at least 70 deaths. Glucose is used also in cheap cider and other drinks; also in treacle, or molasses, and in various table syrups, jams, and preserves; also as an adulterant of honey. One cheap "table syrup" contained 1 grain of arsenous oxide to the pound. Hydrochloric acid, glycerin, and vinegar may contain arsenic, due to faults in their preparation. Various cheap foods, in which either glucose or glycerin is used, may be contaminated. A so-called "chocolate powder" was recently sold in England which contained large quantities of oxide of iron, contaminated with arsenic. Other candies have been similarly adulterated. Another source of arsenic in beer is malt contaminated by fumes of gas coke.

The Royal Commission which investigated the Manchester epidemic also found arsenic in the dried fish and other articles of food taken by sailors suffering with beri-beri, but they concluded that beri-beri cannot be laid to the account of arsenic.

Since these exposures, it is probable that these abuses have decreased.

Various enamels used on cooking utensils contain arsenic, although it is claimed that this danger is not so common now as formerly.

Some years ago attention was called to the alleged habit of arsenic eating by the peasants of Styria, and general skepticism was expressed about it. MacLagan visited Styria, and satisfied himself, but not everyone else, that the practice prevailed among a few; 5 to 6 grains were taken at a time, a statement which seems incredible, but which, if true, throws some light on the tolerance to be attained in chronic poisoning. MacLagan says that tolerance to a considerable extent can be established in dogs and horses.

Symptoms.—The symptoms of arsenical poisoning are acute and chronic.

In *acute* poisoning there is vomiting, pain, diarrhea, extreme prostration, and, in the later stages, anesthesia, paralysis, and delirium.

The vomiting usually comes on in a few minutes, or in less than an hour. It is preceded or accompanied by an intense burning pain in the throat, gullet, and stomach, and a metallic taste. The pain soon spreads to the whole abdomen, and takes the form of a colic. Purging follows. The discharges are, first, the contents of the stomach and bowels; then they become bilious, and finally the alvine discharges present the rice-water form, which is so characteristic. Mucus, blood, and shreds of epithelium are also mixed with the dejecta. Excessive thirst and suppression of urine are present.

With the increasing prostration nervous symptoms may appear. These are caused by a peripheral multiple neuritis. There is anesthesia, cramps, pain, and a flaccid paralysis of the limbs, with abolished reflexes. Convulsions and delirium may close the scene. The symptoms sometimes abate, but the remission is not always complete, and the patient finally sinks and dies. Cases are on record, however, of recovery from large doses. Skin eruptions, such as urticaria, vesicles, pustules, and petechiæ, sometimes appear.

Anomalous forms occur, in which some of the usual symptoms are wanting. Such are the stuporous, or narcotic cases.

In *chronic* poisoning the symptoms are those of irritation of the gastrointestinal and respiratory tracts, such as dryness of the throat, cough, nausea, loss of appetite, colicky pains, and diarrhea, with mucous discharges. Irritation of the conjunctiva and of the nasal mucosa is sometimes observed. There is languor, with loss of strength and weight. A brown pigmentation of the skin is said to be characteristic, and keratosis and eruptions on the skin occur, especially if the arsenic has been applied locally, as from dyes and pigments. These are sometimes seen about the finger nails; also upon the eyelids and upon the genitalia.

Very important are the nervous symptoms, which, as already said, are largely those of a multiple neuritis, such as pain in the nerve trunks and in the muscles, anesthesia, cramps, and a flaccid paralysis with abolished deep reflexes. Toxic amblyopia has been seen. Headache, neurasthenic and hysterical symptoms, and more rarely convulsions, are observed. Popow claimed that he had caused myelitis and anterior poliomyelitis by experiments on the lower animals. In the epidemic in England, already referred to, cases were mistaken for chronic alcoholism, cirrhosis of the liver, Addison's disease, and locomotor ataxia. The diagnosis may be obscure and difficult in cases in which exposure to the poison is not known or suspected.

In poisoning with arseniuretted hydrogen the symptoms are an olive-green tint of the skin, headache, vomiting, chilliness, fever, hemoglobinuria, bile in the stools, enlargement and tenderness of the liver, enlargement of the spleen, and a large number of erythroblasts in the blood.

Treatment.—In *acute* poisoning the antidote for arsenic should be given as promptly as possible. This antidote is the freshly precipitated sesqui-

oxide of iron, with magnesia. The United States *Pharmacopæia* recognizes the *ferri oxidum hydratum cum magnesia*, sometimes called the *antidotum arsenici*. Either ammonia or magnesia may be used to form the precipitate by adding it to the tincture of the chloride of iron. As the resulting precipitate has to be repeatedly washed to free it from the ammonia, the use of magnesia is preferable, especially as magnesia is itself an antidote. Dyalized iron may be given without precipitation. Monsel's solution, to form a precipitate, is said by Hare to be too irritating. According to Wood, the antidote should be freshly prepared and given in great excess, as at least 8 grains of the iron are required to neutralize 1 grain of arsenous acid, and it is in itself harmless. It is best given in hot water. The saccharated oxide of iron has also been recommended, but the sesquioxide is more readily prepared, and has stood the test of experience. Carbonate of sodium may also be used to form the precipitate, and is usually readily obtained.

In most cases copious vomiting has occurred before relief is at hand; nevertheless, it is well to wash out the stomach at the same time as, or immediately after, the antidote has been given. If free vomiting has not occurred, and especially if the poison is mixed with food, an emetic, such as mustard or sulphate of zinc, or even a hypodermic dose of apomorphine, may be given. The latter drug, however, may not act as promptly as is necessary unless a rather large dose ($\frac{1}{8}$ to $\frac{1}{4}$ gr.) is given, and the depressing after effects of a large dose must not be forgotten. In children and feeble persons it is not well borne, and large doses are not permissible. The object being to neutralize the poison and empty the stomach as soon as possible, antidotes and the stomach pump are the means most to be relied on.

In cases of *chronic* poisoning the two objects sought are to remove the cause and to cure the patient.

All manufacturing processes into which arsenic enters, whether of necessity or by accident, should be rigorously inspected and controlled. This is a subject of hygiene into which it is not possible to enter fully here. Almost all civilized countries have factory laws regulating these things.

In the matter of sulphuric acid it is said that it can either be made practically free of arsenic or can be dearsenicated afterward. As it may be the means by which arsenic enters food or drink, it should be carefully inspected. This is particularly so in the case of glucose. The Royal Commission, above cited, said that no substance should be used for food which contains a larger proportion of arsenic than $\frac{1}{100}$ gr. per pound or per gallon.

The symptoms of chronic poisoning will, as a rule, promptly subside if the patient is removed from the action of the cause. The irritation of the stomach and bowels and the various skin eruptions tend to recover without special treatment. An antidote by the stomach is not called for in these cases. The lassitude and loss of weight should yield to diet, tonics, and time.

In the case of paralytic symptoms, the prognosis for prompt recovery

is not so good. All cases of multiple neuritis are, as a rule, slow. They should be treated as advised for lead palsy, that is, with strychnine, electricity, baths, massage, tonics, and a liberal diet.

Organic changes in the tissues are sometimes induced by arsenic, especially fatty degeneration. Of course, these changes, if present, may retard or even prevent entire recovery. There is no drug that will correct this degeneration, or even arrest it so long as the direct action of the poison continues. Iodide of potassium is said to aid in the elimination of arsenic, and should be used in these cases.

Copper, Tin, Zinc, Brass, and Bronze.—These three metals are often found in association in ores, and they are combined in the arts to make various alloys, especially brass and bronze. They are, therefore, best considered as a group, for in case of poisoning it is sometimes difficult to say that the symptoms are due entirely to one or the other metal.

Copper is found in the metallic state and in various ores. It is from the pyrites or sulphide that much of the commercial copper comes. The metal is often found in association with tin, zinc, antimony, arsenic, mercury, and silver. Copper also enters largely into several useful alloys, such as brass and bronze.

In all processes in which copper is worked (and they are very numerous) the most danger arises from dust. Thus the workmen are more exposed in turning and filing than in smelting and foundering, and in processes in which the work is done by hammering. Absolutely pure copper is probably not much used, the metal being generally alloyed to some extent. The fine dust raised by filing and turning displays its cupric character by its color when a ray of sunlight passes through it.

The injurious effects that come from working the various alloys, especially brass, may not be due to the copper alone, but partly to the zinc, and sometimes also to lead.

Brass is composed of copper and zinc in slightly varying proportions, and some specimens contain tin and lead. There is risk in mixing and casting brass and bronze, especially from the fumes. Various alloys are known as gun metal, bell metal, white metal, etc. Bronze is an alloy of copper and tin, and a varying amount of lead is present in it.

The manufacture of verdigris, or acetate of copper, is said not to be a dangerous trade, but cleaning old copper vessels, coated with this salt, which is done by scraping, is the occasion of poisoning. The founders of bronze and brass objects may be poisoned by handling the sand over and over which they use for moulds.

Sulphate of copper is added to canned peas and other vegetables in order to produce an intense green color. Wiley says that this adulteration is not practised in this country. Some authorities claim that it has never done harm. Copper may appear in wine from the treatment of the diseased vine with some cupric preparations.

Tin is found both as an oxide and a sulphide. The largest mines are in Cornwall, England. The ores contain also copper, lead, and arsenic. In the Cornish mines, which are very deep, the miners suffer from the effects of bad air, dampness, heat, and the physical effects of hard labor

and climbing. Some of these mines are more than a thousand feet deep, and the temperature at the bottom may be as high as 125°. Bronchitis emphysema, asthma, and tuberculosis are among the commonest diseases in the miners. Louis says that the death rate among these men is high.¹ In extracting the metal from the ore the fumes of sulphurous and arsenous acid are given off, and may cause poisoning. Tin in its commercial uses is not very injurious. In tinplate works there is possibly some risk from inhaling particles of metal in the air.

Zinc is obtained largely from zinc blende, which contains a sulphide of the metal in association also with lead and arsenic. Roasting zinc blende gives rise to fumes of sulphurous and arsenous acid, and it is these substances rather than the zinc which are dangerous. Much controversy has arisen as to the exact role played by zinc in the diseases of brassworkers. Greenhow believed that the symptoms were due to the fumes of zinc that rise in the process of mixing the alloy; but when it is considered that copper and lead, and even arsenic, are present, it is seen how difficult it is to determine the offending agent. I will consider this subject in discussing "brassworker's ague."

According to Wiley a considerable trace of chloride of tin and of zinc salts may be present in some specimens of molasses, derived from the process of bleaching, and may be injurious. Tin and zinc may gain entrance into canned foods from the can or from the solder.

Symptoms.—Acute poisoning from either copper, tin, or zinc alone must be extremely rare. The reports of cases of illness among workers in these metals indicate that their sufferings are rather due to arsenous and sulphurous acid, and even to lead.

Among copper workmen a green discoloration of the hair, beard, and teeth is seen, and Chevallier said that even the urine is green. Irritation of the gastro-intestinal and respiratory tracts is caused by copper dust. Fibroid phthisis is a possible result.

Verdigris, or acetate of copper, is an active gastro-intestinal poison.

The curious affection known as "brassfounder's ague" is seen not only among workers in brass, but also in other metals, especially lead. There is a feeling of illness, then a chill, with fever, sweating, headache, arthralgia, and subsequent prostration. No periodicity is observed. In earlier days controversy arose as to the cause. Greenhow believed it was the zinc; others pointed out that zinc alone never caused such symptoms. There is probably some infection, acting upon a system overworked and suffering with a combined metallic dyscrasia.

Treatment.—The treatment of acute or chronic symptoms, when these are due to lead or arsenic, has already been considered.

In brass and bronze foundries, and in all other works in which these metals or alloys are used, prevention by proper ventilation and other means is the only rational treatment. The general ill health should be treated on general principles. There is no specific or proper antidote.

¹ Mining, in Oliver's *Dangerous Trades*, p. 535.

Phosphorus.—The chief commercial use of phosphorus is for making matches, hence the great majority of the cases of poisoning occur in that industry. The process for obtaining phosphorus from bones is said to be unattended with danger, and therefore does not concern us here. Neither is it necessary to attempt to describe the processes involved in manufacturing matches. These have no doubt been changed and improved in many of their details, and even the materials used are not always the same. Extensive factories exist in this country.

Oliver says that the total number of cases of industrial phosphorus poisoning in Great Britain for twenty years preceding 1899 was 102. I have no figures for America. Much has been written on the subject, and the industry in most countries is carefully regulated, with a view to lessening the danger to the workmen. Attention was first called to phosphorus necrosis of the jaw bone in lucifer matchmakers by Lorinser, of Vienna, in 1845.

There are two kinds of phosphorus, the common and the amorphous. The latter, or red phosphorus, is used for making safety matches, and is said not to be dangerous.

Symptoms.—*Acute poisoning* is rare, but not unheard of, among workmen; it is seen oftenest in accidental and suicidal cases. The symptoms, which may be delayed for some hours, are a taste of phosphorus and the odor of it on the breath, burning pain in the esophagus and abdomen, vomiting, and purging. The discharges may be luminous in the dark. Constipation sometimes succeeds the diarrhea. Very soon the liver enlarges, and bile disappears from the stools. The symptoms ultimately resemble those of acute yellow atrophy of the liver, that is, jaundice, pain over the liver, vomiting of a "coffee-ground" material, clay-colored stools, scanty and albuminous urine, and nervous symptoms, such as headache, muscular twitchings, convulsions, and delirium. Widespread fatty degeneration is a result, which may ultimately prove fatal in patients who survive the earlier symptoms. The urine often contains sacrolactic acid, tyrosin, and free fat globules; also the coloring matter of the bile, which gives it a dark color.

The *chronic symptoms* are those that are usually seen in workmen. The fumes are said to cause irritation of the bronchial mucous membrane, inducing bronchitis and pneumonia, also gastric disorder, and some of the symptoms of acute poisoning. Von Bibra obtained these symptoms in animals; also skin eruptions and falling of the hair.

The commonest result, however, is necrosis of the jaw bone. This is a slow, progressive periostitis, beginning with pain in a tooth, resembling toothache. After the extraction of the tooth a foul-smelling purulent discharge begins, the gum ulcerates and recedes, the alveolus is exposed and exfoliates, and sequestra are formed and come away. In time large portions of the jaw (especially the lower jaw) may be destroyed. Constitutional symptoms, such as hectic and emaciation, result. The course of the disease may extend over a long time. The condition is essentially a surgical one.

The opinion has been generally held that this action of phosphorus

is purely local, and is exerted only by way of decayed teeth; that if the teeth are sound no damage results. But there is reason to doubt the accuracy of this opinion. Billroth, from a large experience, held that the poison could act on the jaw bone in persons who had sound teeth. Secondary infection occurs in the diseased bone, and Stockman, of Glasgow, detected tubercle bacilli in the pus.

Treatment.—The antidote for phosphorus was at one time thought to be sulphate of copper, which acts also as an emetic, but it is dangerous if it fails to cause emesis, and is not very efficient as a chemical antagonist. Peroxide of hydrogen or a solution of potassium permanganate is far better. Oil of turpentine has long had reputé among workmen, more especially as a preventive, but its value as an antidote is more than doubtful. Hare says that as phosphorus is soluble in oils, the administration of oil of turpentine simply promotes absorption of the poison.

The treatment for necrosis of the jaw bone is entirely surgical, and will not be considered here.

The subject of prevention in this as in all the industrial poisons is a very wide one, but it pertains entirely to the hygiene of the trade, and cannot be discussed here at length. The care of the teeth, personal cleanliness, and a strict regulation of all the details of manufacturing, especially ventilation, are the essentials. Terebinth gargles are recommended by Oliver, whose chapter on the Industrial Use of Phosphorus is exhaustive.

Mercury.—Both the mining and the working of mercury are attended with danger. At the great mines of Almadén, in Spain, which have been worked since antiquity, the work is so hazardous that the Spanish Government has sometimes had difficulty in securing laborers, and has even been forced to employ convicts. The ore consists of cinnabar, which is a sulphide of the metal, and the air of the mines is so charged with mercurial vapors that an amalgam forms on the surface of gold articles carried in the pockets of visitors. Roasting the ore for the purpose of extracting the metal is the most dangerous process, as the mercury is volatilized. Mercury is obtained in this country in large quantities from the quicksilver mines of California.

The uses of mercury in mining and in the arts are numerous. In gold and silver mining it is used to form an amalgam, and thus to facilitate the extraction of these metals.

In the old processes of gilding and silvering the precious metals were applied as amalgams; the mercury was then driven off by heat, leaving a very hard and durable gold or silver surface. This process, known as fire-gilding, gave rise to volatilized mercury in the air, and was very dangerous to the workmen. It has probably been replaced to a great extent by electroplating, to which, however, it is said to be superior.

The Venetian mirrors were made with an amalgam of tin and mercury, a trade which was recognized for centuries as dangerous. The makers of scientific instruments containing mercury, such as thermometers and barometers, are occasionally poisoned. A curious mode of mercurial

poisoning is the making of felt hats, instances of which have been reported in Newark, New Jersey. The fur is treated with the acid nitrate of mercury in order to promote the felting, and the vapors are given off when the felt is worked into hats.¹ Mercurial salts are also used by furriers and taxidermists. Nurses frequently employ an antiseptic solution of corrosive sublimate, but instances of poisoning are very rare. Legge² says that the manufacture of incandescent electric lamps, in which mercurial pumps are used to create a vacuum, is attended with risk; also the manufacture of electrical meters. Some risk probably arises also in chemical works, in which the various mercurial salts are made, but cases of poisoning appear not to be numerous.

Symptoms.—*Acute* mercurial poisoning does not much concern us here, as it is not common among workmen. It is caused by the action of a large, or poisonous, quantity of metallic mercury or one of its numerous salts. Corrosive sublimate, for instance, in poisonous doses, causes gastro-intestinal irritation, vomiting, purging of mucus and blood, abdominal pain, inflammation of the kidneys, syncope, collapse, and death. Large repeated doses, not immediately fatal, cause also stomatitis and the symptoms commonly known as salivation, with dropping out of the teeth, but this is rather one of the results of chronic poisoning. The antidote to corrosive sublimate is white of egg.

It is the *chronic* poisoning which is usually seen among workmen. The symptoms are salivation, stomatitis, ulceration of the gums, necrosis of the jaw, dropping out of the teeth, a horrible fetor of the breath, digestive disorders, loss of weight, anemia, albuminuria, and nervous affections, such as tremor and paralysis. Some acute or subacute symptoms may appear if the workman has been exposed to large quantities of the volatilized metal. Roussel, who studied the cases at Almaden, observed acute salivation in some young novices among the miners, but it was the slow chronic form that was the more common, and this was marked by slow ulceration, receding of the gums, loosening and falling out of the teeth, and an insupportable odor of the breath. Emaciation and anemia were common, and at thirty-five years of age the miners were usually toothless and prematurely aged. Among women exposed to the metal, chlorosis was common and abortions frequent. "Mercurial scurvy" has been described, in which the victim is anemic, emaciated, with falling teeth, fetor of the breath, diarrhea, falling of the hair, rheumatic pains, and edema.

The nervous affections are sometimes well marked. Among the most common is tremor. It usually appears as a late symptom in chronic cases, but occasionally it is primary. It begins as a fine movement in the upper extremities, extending later to the face, neck, tongue, and legs. It tends to increase in amplitude and to become jerky and incoördinate. It is not always absent during repose, and it is increased by volition and emotion. The speech may be affected. French writers have called

¹Dennis, Report of Board of Health of New Jersey, 1878; Lloyd, Diseases of Occupation, in Twentieth Century Practice, iii, 350.

²Oliver, Dangerous Trades, p. 436.

attention to the resemblance of this tremor to, and even its identity with, hysterical tremor.

The paralysis seen in chronic hydrargyrisms has the type of a multiple neuritis. It may be limited to a few muscles or be more general, and is usually marked in the extensors. The larynx is also involved. The muscles waste and the deep reflexes are abolished. The paralysis is accompanied by intense pains in the limbs.

Kussmaul, who studied mercurial poisoning among the workmen employed to silver mirrors in Fürth and Nuremberg, called attention to the mental changes, such as stupidity, melancholia, nervousness, and what we now call neurasthenia. A true confusional insanity, with hallucinations, is sometimes seen. The offspring of these workers in mercury are often defective.

Treatment.—The treatment for *chronic* mercurial poisoning, with which alone we have to do here, is not promising so long as the patient continues to expose himself. Drugs are of but little avail. Iodide of potassium is said to promote elimination, and sulphur baths are claimed to cause the excretion of mercury by the kidneys. A mouth wash of chlorate of potassium is a favorite remedy for the stomatitis. The necrosis of the jaw requires surgical treatment. Change of occupation may be imperative. At Almaden it is said that the miners are periodically sent away from the mines to do agricultural work.

As in all the industrial poisonings, prevention is the great desideratum. This is to be accomplished by proper hygiene, and this hygiene will depend upon the details of the particular work. Ventilation is of first importance. Among the hatters of Newark, New Jersey, it was observed that the symptoms were worse in cold weather, when the men worked in close rooms, with the windows shut.

Carelessness and indifference on the part of the workmen must be combated. After quitting work the men should bathe and change their clothing; they should not eat with soiled hands, nor eat or sleep in rooms containing contaminated air. The various industries in which mercury is used are now regulated by law in most countries. By the French law certain of these industries are forbidden to women and children.

The nervous affections are to be treated as already described in the section on Lead. The paralysis requires rest, massage, electricity, strychnine, and tonics, especially iron. Intemperate habits are reported among some of these workmen, and they, of course, should be corrected. Alcohol promotes multiple neuritis.

The tremor, as already said, has close analogies with hysterical tremor, and cases are reported of good results from suggestive therapeutics, by which is meant largely a favorable mental impression. I have known cases of hysterical tremor of long standing (but not from mercury) to recover in a very astonishing way. To understand these cases it is well to recall that the mere conviction in the mind of a susceptible person that he or she is poisoned is enough to make a very shocking impression. Hysteria may easily be engrafted on such a state. These patients do best

by being isolated, fed carefully, bathed frequently and systematically, and convinced firmly that they can and will recover.

Carbon Monoxide and Carbon Dioxide.—These two compounds are formed by the combustion of carbon. If an imperfect quantity of oxygen is present, the monoxide results. It occurs in the burning of coal and illuminating gas, in smelting iron ores, and especially in making lime from limestone. Many deaths have been caused by it about lime-kilns. In all industries in which charcoal is used this gas is liberated. As one of the constituents of "water gas" it has proved noxious. It occurs also in mines in the so-called "after-damp" and as a result of the explosion of gunpowder in blasting. It is especially dangerous because it is colorless, odorless, and tasteless. It burns with a pale blue flame, so familiar in a hard-coal fire.

Carbon dioxide, or carbonic acid, is also formed by the combustion of carbon, and therefore occurs under the same circumstances as the monoxide. In fact, these two gases are usually present together, and act together, in cases of poisoning. The dioxide is formed when the monoxide is burned. It is a product also of the decomposition of vegetable and animal remains, and is present in and about volcanoes, mines, tunnels, cisterns, wells, and even cemeteries.

Oliver says that in the London underground railways these two gases are sometimes present in injurious quantities. The danger is not so much to the passengers, who pass rapidly through these subways, as to the employees, who have to remain in them for long periods. The use of electricity as a motive power instead of steam, of course does much to avoid this evil.

Symptoms.—Carbon monoxide is a narcotic poison and is highly dangerous to animal life; 10 per cent of it in the air is fatal, and much smaller quantities have proved lethal. Its action is upon the blood and nervous system. The victim falls into a deep sleep, which passes into coma and terminates in death. The coma may continue for many hours, resisting all attempts to resuscitation. The pulse and respiration are slow, and convulsions sometimes occur in advanced stages. Small doses cause nausea, vomiting, vertigo, and headache. The blood is of a bright cherry red, giving the patient's complexion a pink hue and showing characteristic changes to the spectroscope. The action on the blood is due to the combining of the carbon monoxide with the hemoglobin, forming a very stable compound, which prevents the taking up of oxygen. The patient is thus practically asphyxiated.

Carbon dioxide is not as active a poison as the monoxide, but in large poisonous doses causes somewhat similar symptoms. As the two gases are usually mixed, it is difficult to assign to each its particular action. In poisoning with the dioxide the heart and lungs contain black blood in contrast to the bright colored blood seen in poisoning by the monoxide.

Treatment.—The inhalation of pure oxygen is the best remedy, as it hastens the expulsion of carbon monoxide from the blood. It also acts by supplying a small amount of oxygen, which remains free in the blood (not combined with hemoglobin), and this free oxygen supplies the tissues.

Artificial respiration is necessary in some cases, and the patient should not be exposed to cold air. It should not be forgotten that changes occur in the brain, heart, and other organs, and that these changes retard recovery, even after the carbon monoxide has been driven off. Hence, grave symptoms, such as stupor, paralysis, and even coma, may persist for several days, and relapses occur, ending in death. To combat the fatal tendency, heart and nerve tonics should be given, especially strychnine. The use of alcohol is not indicated. Electricity, as a respiratory stimulant, has a limited use.

Transfusion of blood has been suggested; also the intravenous injection of normal salt solution.

Bisulphide of Carbon.—Poisoning from this substance occurs in india-rubber works. The bisulphide of carbon is used as a solvent of caoutchouc in the process known as vulcanizing. The details of this work are somewhat intricate, and need not detain us here. It is enough to know that this form of poisoning is a very common danger to the india-rubber workers.

Bisulphide of carbon is also used in the arts as a solvent for sulphur, phosphorus, camphor, and other substances. When pure it is colorless, and has a sweet ethereal taste and smell, but as commonly used, it is mixed with sulphur and has an offensive odor.

Symptoms.—Delpech, who first described this poisoning, which he observed among the india-rubber workers in Paris, called attention to two stages: first, of excitement, then of stupor or collapse. A resemblance to alcoholic intoxication has been suggested. In the first stage there are excitement, talkativeness, vertigo, headache, amblyopia, nausea, and insomnia. This constitutes in many cases a sort of subacute poisoning, seen especially in girls, and persisting from day to day. There is a constant taste of bisulphide of carbon, which interferes seriously with the taking of food.

A second stage, or properly a more advanced form, is marked by mental changes, loss of memory, indifference, inability to concentrate the attention, loss of weight, and weakening of the sexual function.

Peripheral multiple neuritis is not uncommon, and is marked by a flaccid paralysis in the limbs, loss of the deep reflexes, pains, and anesthesia. Incoördination, or pseudotabes, is sometimes seen.

Acute melancholia and mania are met with, and cases of suicide have been reported. Toxic hysteria, an affection much discussed by the French, is particularly common in the victims of this poisoning, and has been observed also by Oliver in England.

Lazarus has reported cases of necrosis of the jaw not unlike that caused by phosphorus.

Treatment.—Prevention is, of course, better than cure; it is to be effected by proper hygiene, especially ventilation. The vapor of bisulphide of carbon, being heavier than air, is best carried off by ventilators which have their openings near the floor. Personal cleanliness, bathing, and change of clothing are important, but they cannot take the place of ventilation. This industry is regulated by law in most countries. In

England there are special rules in the Factory Acts by which no child or young person is allowed to work in any room in which bisulphide of carbon is used; no person is permitted to work for more than five hours in any day in a room in which this substance is used, nor for more than two and one-half hours at a time without an interval of at least an hour; no food is allowed to be eaten in any such room; all workpeople must undergo a medical examination once a month; and many details of the work, not necessary to be mentioned here, are regulated. These rules serve as illustrations of what is necessary in the case of this as well as of many other industrial poisons.

In mild cases the symptoms disappear promptly when the patient is removed from the action of the cause; but in grave cases, especially when the nervous system is badly affected, as in multiple neuritis and insanity, the progress may be slow. Confinement in a hospital or asylum may be necessary. The paralytic symptoms are best treated with rest, massage, electricity, liberal diet, strychnine, and tonics, as described for lead palsy. Alcohol should not be used in the treatment, as the symptoms closely resemble those caused by it. Phosphorus was highly recommended by Delpech.

As in case of most of the toxic psychoses, the question may arise as to the use of powerful sedative drugs to combat maniacal symptoms. Hydrobromate of hyoscyne is probably the best of these. Veronal, chloral, and the various bromides are often used, and may in some cases be necessary; but it is well not still further to poison a patient who is already poisoned enough, but to rely largely upon time, skilful nursing, and good feeding to effect a cure. Systematic bathing, especially the hot bath, is highly approved now to the treatment of mania. Care must be taken, however, to guard against its depressing effects.

The Chromium Salts.—The bichromate of potassium and the bichromate of sodium are largely used, especially for the manufacture of colors, such as the chromate of lead; for dyeing and calico printing; as a mordant for wool; in photography; and as an oxidizing agent in the manufacture of coal-tar colors. They have other uses also not necessary to be defined here.

The principal danger arises in the manufacture of the potassium and sodium salts, especially from the dust which is given off. These salts are made from chrome ironstone. In all industries, however, in which these substances are handled some of the injurious effects are observed.

The commonest lesion is perforation of the nasal septum, which is caused by inhaling the dust. Coryza and pharyngeal and bronchial catarrh are initial symptoms. This perforation was found by Legge in 126 out of 176 workmen in a "chrome house" or factory. Hime said that this lesion is to chromium what necrosis of the jaw is to phosphorus. Sneezing, epistaxis, and a purulent coryza precede the perforation, which in itself may be comparatively painless, so that the victim himself does not always know that he has it. The sense of smell is affected in a few cases.

Certain characteristic lesions of the skin are also seen. These are

indolent and burrowing ulcers, occurring especially in places where the skin from any cause had been broken. They are very painful, and discharge a seropurulent fluid. They are seen especially on the hands and feet. Heathcote has reported ulcerations on the tonsils, simulating syphilitic sores.

Internally the chrome salts are violent irritant poisons, but internal poisoning is not common among workmen.

Treatment.—The treatment of the nasal and skin lesions is entirely local, and cannot be described here. Prevention by ventilation and the proper care of the skin is important. These various industries, especially the manufacture of the bichromates of potassium and sodium, are usually regulated by law, with a view to securing proper hygiene. In some instances, as in photographing, rubber gloves should be worn if the skin becomes irritated. There are no drugs that are in any sense antidotal.

Sulphur and its Compounds.—From our standpoint the several compounds of sulphur are more important than sulphur itself. The latter does not figure largely as an industrial poison. It is a source of some annoyance and of slight illnesses in workmen who grind it.

Sulphurous acid gas is the commonest and one of the most injurious of the sulphur compounds in industrial life. It is liberated in large quantities in smelting various ores, especially the lead ore, galena; the tin ore in Cornwall; the copper pyrites; and the mercurial ore known as cinnabar. All these ores contain sulphides of the respective metals. In some instances they also contain arsenic, and the fumes of arsenous acid are also emitted. Sulphurous acid gas is liberated in the burning of sulphur, and in various chemical processes it arises directly from sulphuric acid. It is not possible to review all these technical processes here. Another extensive use is in bleaching. I once saw illness in a brick-maker which had been caused by exposure to sulphurous acid, carbon monoxide, and carburetted hydrogen in the course of the man's work.

Sulphuric acid is highly corrosive in its local action, but except in the case of accident it does not cause serious inconvenience among workmen. In the course of its manufacture sulphurous acid is given off, and may be injurious. Some specimens of sulphuric acid contain arsenic, and this latter may act, especially in glucose made by means of contaminated acid, as has been described in these pages under the head of Arsenic.

According to Laurie, sulphuretted hydrogen, which is very poisonous, is a product of the recovery of sulphur from sulphide of lime.

Symptoms.—The action of sulphurous acid gas is upon the respiratory tract, lungs, stomach, bowels, nervous system, and blood. It is an irritant, and, although inhaled, seems to be rather more injurious to the gastrointestinal tract than to the lungs. It causes vomiting and epigastric pain, but also cough and symptoms of bronchial catarrh. It is a depressant to the nervous system, and may even cause convulsions and death. Still, from all accounts, this gas does not seem to be responsible for much disease among workmen.

Sulphuretted hydrogen is much more dangerous; breathing it in large

quantities for a few minutes results in coma, often followed by death. Laurie says, however, that the breathing of small quantities, well diluted with air, is not specially injurious. Transient symptoms are loss of appetite and a general feeling of ill health, but the workmen soon become accustomed to it.

Treatment.—As in all occupations in which dust or fumes are given off, the first requisite is ventilation. This is provided for in most of these industries either by the common sense of the employer or, as is more efficacious, by law.

Hime recommends absorbent media, such as water, milk of lime, metallic oxides, and sawdust, but how these are used to practical advantage I do not know.

For poisoning with sulphuretted hydrogen, pure oxygen is the best remedy, and Laurie says that a cylinder of this gas is kept in the works.

It is evident that preventive measures are a part of the general hygiene of these industries, and must depend upon local conditions. They are not properly therapeutic.

Hydrochloric Acid.—This gas is evolved in large quantities in the making of sulphate of sodium in the Le Blanc process. This salt is made by the action of sulphuric acid upon chloride of sodium. Hydrochloric acid is an exceedingly irritating and corrosive substance, and the men who are exposed to its fumes suffer from irritation of the air passages. Loss of the teeth is said to be common among them. The men sometimes wear flannel mufflers. They are also exposed to hard work and to extremes of heat and cold, which doubtless contribute to ill health. The excessive use of alcohol is said to be common among them.

Another step in the Le Blanc process is the manufacture of bleaching powder from the hydrochloric acid. This process is technical, and need not be described here. Chlorine gas is evolved in some stages.

The only remedies are ventilation, proper hygiene, personal cleanliness, and correct habits.

Hydrochloric acid frequently contains arsenic, and as it is extensively used in the preparation of foods and drinks, there is danger of this poison being thus introduced. (Thresh and Porter.)

Chlorine.—In the process just mentioned bleaching powder is made by the action of chlorine upon lime. Chlorine is much used in bleaching. In the process of making the powder the workmen suffer from the effects of the chlorine, which acts as an irritant to the throat and air passages. These workmen also suffer with eruptions on the skin, inflamed eyes, and loss of the teeth, some of these effects probably being due in part to fumes of hydrochloric acid. The labor is hard and pursued under conditions far from hygienic, and the laborers show its effects in loss of weight and color. Tuberculosis is said to be not uncommon among them.

Bromine.—This substance is obtained largely from saline springs, some of which are found in Pennsylvania. In the process the bromine is liberated as a red vapor, and the workmen may suffer from its fumes.

The symptoms are similar to those caused by chlorine, and are largely

those of irritation of the respiratory tracts. Chronic intoxication is said to be rare. Cloths and cotton wool are used to protect the nose and mouth. The inhalation of ammonia is advised.

Iodine.—Iodine is obtained from seaweed. It is an irritant, very similar in its action to chlorine and bromine, and the prevention is to be secured by the same means.

In the manufacture of iodoform there is some risk, but it appears to be slight. Amblyopia, similar to other toxic amblyopias, has been reported in a few instances after its surgical use, but according to Snell this result does not follow upon the manufacture of this drug.

Illuminating Gas, Nitrobenzene, and Aniline.—These three are considered here together, since they are closely related.

Illuminating gas is made by the distillation of coal. It is a compound gas, containing hydrogen and its carburets, the two oxides of carbon, and acetylene. It is highly poisonous, but the manufacture of it is not attended with bad effects on the health of the workmen, hence it does not call for extended notice here.

Nitrobenzene is made by the addition of nitric acid to benzene, which is a constituent of the coal tar which is left from the manufacture of illuminating gas. It is a yellow fluid, with the taste and smell of bitter almonds, and is sometimes fraudulently sold as the "oil of bitter almonds." It is used as a cheap perfume and flavoring agent. Its principal use is for making aniline. It is present also in the manufacture of the explosive known as roburite, and in polishing pastes for shoes and for brass.

Nitrobenzene is a dangerous poison, and numerous instances of its poisonous action are on record. It first causes vertigo, nausea, and vomiting, with blueness of the skin and nails. Later, even after an interval of some hours, coma may occur rather quickly. The patient exhales the odor of bitter almonds. Paralysis and amblyopia have been noted. Symptoms of collapse, with oppressed breathing and rapid pulse, sometimes occur early, and rigidity of the muscles of the jaws and limbs may supervene. The blood evidently undergoes some change, as the blue tint of the skin may persist for quite a long time in patients who recover.

Chronic poisoning is observed among these workmen. Anemia is common, and the skin has a yellowish-gray color; the mucous membranes are also discolored, and the conjunctivæ have a tint of jaundice. The muscles are flabby and even atrophied, and there may be some loss of power. Pains of a shooting or of a rheumatoid kind are present in the limbs; also tingling and itching of the skin. Hyperesthesia is common, and hemianesthesia may present the form of a toxic hysteria. The reflexes are sometimes diminished, and the sexual functions impaired. Toxic amblyopia is seen in some cases. The kidneys also may be involved. These chronic symptoms seem to be observed especially in workmen on high explosives. They have been fully described by R. P. White.¹

¹ The Effects of Dinitrobenzene, etc., in Oliver's *Dangerous Trades*, p. 475.

Aniline is formed from nitrobenzene by the action of hydrogen. Its chief use is in the manufacture of a great variety of dyes and coloring matters. It is in the course of this manufacture that poisoning may occur from the vapor. Some observers have held that the poisoning is largely due to the nitrobenzene, but the better opinion seems to be that the two substances exert a somewhat different action. It is well to recall the fact also that arsenic is used in some of these processes, and may act as a poison, although it is said that if the process is properly carried out none of the arsenic remains in the aniline colors. Of late years arsenic is not so much used as formerly. Coal-tar colors are also made from other constituents of coal tar besides benzene.

Aniline causes vertigo, headache, nausea, vomiting, a blue tint of the skin, convulsive and irregular breathing, feeble pulse, and collapse. The mind may remain clear even although the patient is in extreme danger. He exhales a strong odor of aniline. Mild symptoms, such as nausea, dizziness, and headache, are apt to plague the novice, but a tolerance is established in time.

In some cases spasmodic or tetanic action of the muscles occurs, and delirium and coma are also seen.

Treatment.—Unfortunately there is no very effective treatment except fresh air and time. We have no antidotes. The patient must be sustained, and probably the best remedy for this purpose is strychnine, unless the tendency to spasm is marked. Artificial respiration may be tried, and the inhalation of oxygen. The best preventives are ventilation and properly constructed apparatus. If aniline is swallowed the stomach pump should be used; also cold affusions, ammonia, and stimulants.

For the anemia and general ill health seen in chronic poisoning, iron, tonics, and a liberal diet are the remedies.

The Coal-tar Colors.—Much has been written about the use of the coal-tar colors in food. Leffmann thinks there is no evidence of the injurious action of these colors in this connection. Weyl's experiments on the lower animals proved that some of these colors are poisonous in comparatively large doses,¹ but these poisonous ones are not likely to be used at the present time, as the matter is controlled by law. The coloring power of all these agents is very high; therefore they are present in very minute quantities in foods. Auramin, a yellow pigment that was much used in coloring candy, was added in the proportion of 1 ounce to 2000 pounds. A person who should eat a whole pound of that candy would get about one-fourth of a grain of the color, a proportion which is negligible. The United States Government has laid down rules that all these colors in foods must be free from lead, arsenic, and mercury, and a list of those is given which may be used. Colors are not allowed in food generally, except with notice on the label. The nitro-colors and nitroso-colors are more toxic than the other types. The name of the coal-tar colors is legion, new ones are being constantly added, and they are usually known by trade names, hence they cannot be discussed

¹ The Sanitary Relations of the Coal-tar Colors, translated by Henry Leffmann, Philadelphia, 1892.

here in detail. They have been used to color not only candy, but also preserves, jams, pickles, wines, temperance drinks, soda water, cakes, butter, cheese, meats, and doubtless other things. Although this use may constitute a fraud, it does not necessarily add a poison.

The coal-tar, or aniline colors, as they are often called, although they are not all made from aniline, have almost entirely replaced the metallic colors in foods, and in this respect they have conferred a benefit rather than otherwise. Formerly it was the practice to color confectionery with chromate of lead, red lead, sulphide of mercury, umber and sienna, Prussian blue, carbonate of copper, and arsenite of copper; and white lead was used in ornaments for cakes. With the advent of the aniline dyes all this was changed. (Thresh and Porter.) Sulphate of copper is still used to some extent to color canned peas and other vegetables, as no aniline color has yet been found that will take its place.

Acetylene.—Acetylene gas is a comparatively new illuminant which is coming more and more into use. There are some dangers arising both from its manufacture and its use, for a knowledge of which I am largely indebted to a recent paper by Hamilton P. Smith.

Acetylene is produced from calcium carbide, which is made by fusing together lime and carbon in an electrical furnace under intense heat. When the calcium carbide is dampened with water it gives off the gas known as acetylene.

Accidents may be caused by explosions of the gas and by electrical shock in managing the furnaces, but with these we are not concerned here. We are merely interested in acetylene as a poison.

According to Oliver, if a rabbit is subjected to pure acetylene in a bell-jar it is gradually narcotized, and death results. If only partially narcotized it promptly recovers without ill effects when it is returned to the atmospheric air. Vascular tension is so much increased that it is almost impossible to obtain a drop of blood. Under the usual domestic circumstances, when the gas on escaping would doubtless be mixed with a large quantity of atmospheric air, acetylene is probably not as dangerous a poison as ordinary illuminating gas. Death may result, however, if the inhalation has been long continued and atmospheric air has been excluded. Fatal cases are probably rare up to this date.

The *treatment* is by removing the patient into the open air and using artificial respiration. The high vascular tension suggests the use of nitroglycerin.

Tobacco.—Of the injurious effects of tobacco on the human system there is no question, but that workmen and workwomen who engage in preparing it for use suffer seriously from these effects has been doubted. Some observers, among whom are Galezowski and de Schweinitz, assert that visual trouble, or toxic amblyopia, occurs among these workers who do not use tobacco in any form. On the other hand, several systematic observers in tobacco works, as Shears in England and Dowling in America, failed to find any affection of vision among those who did not smoke or chew.¹

¹ Snell, in Oliver's *Dangerous Trades*, p. 768.

In a brief review of this whole subject, some years ago, I came to the conclusion, after weighing the arguments *pro* and *con*, that the manufacture of tobacco did not appear to be injurious to health. Poisson, who investigated the subject among the tobacco-workers at Nantes, concluded that this industry has no influence upon menstruation, abortion, and postpartum hemorrhage, as had been asserted, and that the workpeople were merely subject to gastro-intestinal disorders; but I think that these were probably due as much to other causes as to tobacco.

In some of these factories, especially snuff factories, there is much tobacco dust, which is an irritant to the eyes and air passages, but the workmen become wonderfully tolerant of it. New hands sometimes suffer from nausea and vomiting. Ventilation is the only remedy.

Dust.—The subject of dust as an injurious factor in industrial life is an extensive and somewhat complicated one, because dust is present in many industries, and it is only one of many factors, even in most of those industries in which its evil effects are most notorious.

For our purpose I shall select only those occupations in which dust is a conspicuous factor. These are the occupations of grinders, miners, potters, glasscutters, stonecutters, workers in cotton and flax, and wool-sorters. The special disease of woolsorters, however, is due to the anthrax bacillus, and will be considered in a section apart.

The grinding of cutlery has always been held to be one of the most injurious of trades. Hall, of Sheffield, England, some years ago wrote an account of its horrors, which even yet can be read with profit, although the sanitary conditions of the trade have been much improved.¹ The grinding is done on circular stones, and the dust raised is a mixture of stone and steel. As the men are forced to bend low over their work, they inhale large quantities of this dust, unless it is effectually removed by ventilation. According to Holland few of the workmen in former days were able to survive at the work until their fortieth year.

The disease from which these men suffer is popularly known as "*grinder's asthma*." It is, in fact, in its ultimate stages a progressive tuberculous disease. It begins as a bronchitis, with asthmatic symptoms, leading to emphysema, and finally ending as a tuberculous infection. In a recent paper Burgess, of Sheffield, has described the pathology of this grinder's "*rot*." A severe indurated bronchopneumonia was formerly thought to be more prevalent than at present, but it is evident that tuberculosis is the destiny of most of the victims. To describe all the stages of this disease is not necessary here.

The only remedy is ventilation and improved hygiene. Of late, according to White, the introduction of fans for carrying off the dust has been followed in Sheffield by improvement in health and increased length of years, but the trade is still an unhealthy one. The places in which these men work are called "*styes*," and according to Hall they were formerly kept in a most unsanitary condition; all of which, of course, should be corrected.

¹ The Sheffield Grinders, *British Medical Journal*, 1857.

Miners are subject to dust according to the substances mined and the local conditions of their work. Hence all are not exposed to danger from dust in equal degrees. The Cornish miners are said to suffer greatly, although the mines are very damp. In this country we are more interested in the affections of coal miners. The dust, of whatever character, being constantly inhaled, sets up an irritation, which induces a form of chronic fibroid phthisis. Thus "miner's phthisis" develops from an initial bronchial and pulmonary catarrh, and in time tuberculous infection takes place. Formerly an attempt was made to distinguish this disease of coal miners, or "anthracosis," from true tuberculosis, but that was before the role of the tubercle bacillus was known. In coal miners there appears to be a deposit of carbonaceous matter, leading to fibroid proliferation. It must not be overlooked, also, that these men are exposed to many other injurious factors, such as hard labor, various kinds of gases, deprivation of sunlight, and bad personal and domestic hygiene. They are frequently subject to rheumatism, anemia, and a form of nystagmus.

Various kinds of quarrying and stone-cutting give rise to dust. The very hard stones, such as granite, do not cause pulmonary trouble nearly so much as do the softer stones, for obvious reasons. Workmen on some of these soft stones are said to be very subject to phthisis, as has been pointed out by Alison, of Edinburgh.

Grinding clay for the use of potters is a dangerous occupation, its number of victims being among the greatest in proportion of all the dust-making trades. The dust is largely silicious, or glassy, hence very hard and irritating. In the Trenton potteries, in New Jersey, the work-people, according to Warmen, suffer from phthisis, rheumatism, lead poisoning, anemia, and digestive disorders. Oliver says that the fibroid lung in early stages is non-tuberculous. Evidently, however, a later infection is common, and the death rate among potters is very high, as many as 40 per cent. of the scourers having phthisis, according to Oliver.

Glasscutters are much exposed to an injurious dust, which contains not only fine particles of glass, but also of lead, or rather of lead in combination with glass. These men are thus exposed to lead poisoning as well as to the irritating effects of the glass dust upon the respiratory organs.

Organic substances, such as cotton and flax, give rise to much dust in some stages of their manipulation, this dust being a mixture of vegetable fiber and mere dirt.

The flax industry is an unhealthy one, many of the workers dying of pulmonary disease, especially tuberculosis. The symptoms are dryness of the throat, cough, dyspnea, occasional vomiting, and the signs in time of tuberculosis. Purdon says that among the Belfast operatives nearly three-fifths of the deaths are due to diseases of the respiratory organs. Other affections are eczema, onychia, folliculitis, and varicose veins.

The dust of cotton is composed largely of cotton fiber, with inter-

mixture of various kinds of dirt. It is an irritant to the nose, throat, larynx, and bronchial tubes. Cough soon ensues, with expectoration. In time a form of industrial or fibroid phthisis develops, and tuberculous infection may occur. Follicular tonsillitis, due to the lodging of cotton fiber in the crypts of the tonsils, has been reported. A sizing of powdered clay is used in some stages of cotton-weaving, and acts as an irritant.

Dust from wood and from grain and flour may be mentioned as capable of doing harm as irritants, and dust from wool and hair may be contaminated with the anthrax bacillus, to be considered in the next section.

Treatment.—So much depends upon the local conditions of these various and widely differing occupations, that a full discussion of prevention cannot be had here. It is a question of hygiene, in which the problem of ventilation is the chief, but not the only one. Disinfection should not be ignored.

When pulmonary disease is threatened the safest course is for the victim to quit the dusty work, but experience proves that even by so doing he will not always save himself from tuberculosis. With our modern ideas of infection, however, we must not allow these diseased operatives to have their own way. Work in a grinder's "stye," or even in a well-ventilated cotton mill, would seem to be an ideal method for propagating tuberculosis from one worker to another. Frequent medical inspection is demanded, also the care and disinfection of sputum. When we reflect how the whole subject is involved with economic questions, and the question of earning a living, we can see at once that it is not to be easily solved.

It seems that lead-glazed pottery could be done away with, and in a recent English report it was advised that because of the disastrous effects upon workmen it be no longer manufactured. A labor union has even recommended to "boycott" it.

This is not the place to discuss the treatment of pulmonary tuberculosis. The treatment of lead poisoning is discussed elsewhere (page 590).

Woolsorter's Disease.—I will consider this subject very briefly here, and merely as an occupation disease, hence not fully as to its pathology. Woolsorter's disease is due to the anthrax bacillus, but anthrax infection is not confined to woolsorters, for it is seen in another form in other workers in wool and hair. It is conveyed by dust and probably also by direct contact with the hands.

The wool and hair from Russia and from South America especially have been the sources of anthrax infection. The woolsorters in Bradford, England, and the workmen who handle hides on the London docks have furnished many examples. In this country epidemics have occurred in the New England States, and isolated examples in many localities.

There are two forms of anthrax infection, the external and the internal. In the external variety a malignant pustule forms, which is attended with great swelling of the surrounding parts, involvement of the lymphatics,

and profound constitutional reaction. Death may occur in a few days. A mild form occurs, followed by recovery. Malignant pustule is probably caused by infection by the hands, and is seen in workmen who handle hair and hides. An erysipelatous edema is also seen.

Of the internal form there are two varieties, the intestinal and pulmonary. The former is marked by vomiting, diarrhea, bloody discharges, excessive weakness, collapse, and, in some cases, death. This affection is caused by eating the flesh of a diseased animal, and is therefore not an industrial disease.

The pulmonary form is the affection known properly as woolsorter's disease, because it occurs especially among these workmen. It is caused by the spores of anthrax, which are probably inhaled with dust. It was first recognized by Bell, of Bradford. There may be no local sore, but the disease begins with a sudden sense of illness and weakness, pain in the chest, and oppression of breath. Rales are heard, and an effusion into the pleura is sometimes present. Collapse comes on quickly, and death may occur in a few days, or even hours. Chills and a rise of temperature are apparently not always observed.

Treatment.—Preventive measures are usually adopted. Hime's rules, which are observed in Bradford, require that suspected wools be washed, disinfected, and sorted while damp. Ventilating fans are also used, and the dust is burnt. No person having an open wound is permitted to work. Ventilation and disinfection are carefully carried out. The spores, by which this form of the disease is probably conveyed, are minute spherical bodies, and are exceedingly resistant even to heat, also to the digestive fluids.

The treatment of the patient is best carried out by sustaining measures. Stimulation with alcohol and strychnine is essential. Some observers have recommended quinine in large doses. A protective inoculation was introduced by Pasteur. Woolsorter's disease is usually so rapid in its progress that there is unfortunately not time to do much. Bell says that the time may come when antitoxins can be used with success, but heretofore these have been used only in the external form.

Malignant pustule is a surgical affection, the treatment of which cannot be discussed here.

The intestinal form of anthrax infection should be treated in the early stage with emetics, especially ipecacuanha, and purgatives; afterward with sustaining measures. Strümpell recommends salicylic acid as an intestinal disinfectant.

Quinine.—To the manufacture of quinine is attributed a troublesome skin eruption which affects the workmen. This eruption is of the nature of a purulent eczema. A dermatitis, called by specialists dermatitis venenata, is also seen. According to some observers the purulent eczema may be a grave matter, interfering with the workman's continuing his work. The affection annoys new workmen especially, but apparently some of them never become accustomed to it.

The *treatment* is by means ordinarily used by dermatologists for eczema, and by protecting the exposed parts as well as is practicable.

Gunpowder, Guncotton, Nitroglycerin, Dynamite, and Other Explosives.—I will make no attempt to describe fully the chemistry or the manufacture of the various explosives which are now so widely used, but will merely point out their injurious effects as poisons upon health. This is not the place either to discuss the various accidents which may occur from their explosion.

Gunpowder is too well known to need description. Its explosion generates carbon monoxide, which is a deadly poison. Nitroglycerin is made by the action of nitric and sulphuric acids upon glycerin. Guncotton is made by the action of nitric and sulphuric acids on cellulose or the fiber of cotton. In 1875 Nobel discovered that a powerful blasting gelatin could be made by dissolving guncotton in nitroglycerin. Dynamite is a preparation of nitroglycerin. Lyddite, or picric acid, is made from carbolic acid, sulphuric acid, and nitric acid. Another group, of which roburite is an example, is made by the admixture of nitrate of ammonium and various carbon compounds, such as naphthalene and nitrobenzene.

All these explosives contain carbon, and this carbon is burned in their explosion. If there is a deficiency of oxygen, carbon monoxide (CO) results; if the oxygen is sufficient, carbon dioxide (CO₂) is generated, which is less poisonous than the monoxide.

It is in mining and other underground work that the fumes from these explosives exert their worst effects. Gunpowder is particularly dangerous, and guncotton is said to be even worse, yielding as much as 45 per cent. of carbon monoxide. Instances are on record of many men being overcome by the fumes from a single monster blast of gunpowder, some of them suffering death. Efforts have been made, by mixing the explosives with some substance supplying oxygen, to remedy this evil. The poisonous action of carbon monoxide has already been described, and need not be discussed again.

If nitroglycerin is burned, not detonated, the fumes of NO₂ are given off, and may be dangerous to those exposed to them. According to Cooper Key, the symptoms of poisoning by these nitrous fumes may be for some time delayed, the victim even eating a meal, but after a while a difficulty of breathing comes on, with distressing cough, and the patient may sink and die. The peculiar physiological action of nitroglycerin is felt by workmen making or handling it. The chief symptom is an intense headache, caused by dilatation of the capillary bloodvessels. Novices at the work may suffer for days, or even weeks, before becoming inured to the fumes, but Key says that no permanent harm results.

In making explosives in which nitrobenzene and naphthalene are used the workmen may suffer from the fumes, and fatalities have been recorded. The action of nitrobenzene has already been described. Naphthalene is not so poisonous as benzene; nevertheless, beta-naphthol has been known to cause death,¹ and alpha-naphthol is still more toxic.

Treatment.—There are no antidotes for any of these poisonous fumes. Fresh air, artificial respiration, the inhalation of oxygen, stimulants,

¹ Stern, *Therap. Monatshefte*, 1900, p. 165.

especially strychnine, and hypodermoclysis, with normal salt solution, are the remedies. Strong coffee is the best remedy for the headache caused by nitroglycerin.

Caisson Disease.—This affection, as a disease of occupation, is properly discussed here, although it is not due to poisoning. It is true that the theory has been advanced that its peculiar symptoms are due in part to the action of carbonic acid gas; but this is a theory which the pathology and symptoms of the disease do not support. Other theories, as that of gas emboli, have been advanced, but these need not be considered here, since they furnish no solid ground for treatment.

Caisson disease is caused by working in compressed air. The caisson is a large compartment, sunk under water, and filled with compressed air in order to counteract the pressure of the water from without, and thus to allow the men to work on the foundations of piers for bridges. The two most noteworthy examples in this country have been the Brooklyn Bridge and the bridge across the Mississippi River at St. Louis. Both these great bridges furnished many cases of this disease. The pressure at the St. Louis bridge was more than three atmospheres, the normal pressure of the atmosphere being fifteen pounds to the square inch.

The first symptoms appear soon after the workman emerges into the open air. Epigastric pain with vomiting occurs, followed by pain in the back, especially in the lumbar region, the pain shooting down into the legs. This pain may be very severe, and is of a tearing character. Loss of power and anesthesia in the legs soon follow, with incontinence of urine and feces. In some cases paralysis is also present in the arms. Brain symptoms are occasionally present; they are headache, vertigo, and, in severe cases, coma, sometimes followed by death. Bronchial catarrh and perforation of the eardrum are sometimes seen. The prognosis in the main is favorable, although a few cases prove fatal.

In a few autopsies that have been held, especially one by Van Rensselaer, a necrotic area has been observed in the spinal cord, with ascending and descending degeneration in the tracts of the white matter.

Treatment.—The first thing to be considered is prevention. This subject was given much thought by Andrew H. Smith, who had charge of the cases at Brooklyn, and by Jaminet, at St. Louis.¹ The greatest risk is incurred during the process of "locking out," that is, in coming from the caisson into the outer air. This is done through a lock, in which the normal atmospheric pressure is gradually attained. During this process there is a marked fall of the temperature of the air, which acts injuriously on men overheated and exhausted by hard toil. Jaminet made a rule that the time consumed in coming out should be one minute for every six pounds of pressure, and that the men should be warmly clad. Oliver recommends one minute for every three pounds. Another factor that

¹ See the present writer's article on the Diseases of Occupations, in the *Twentieth Century Practice*, iii, 435, where the whole subject of the caisson disease is reviewed at length. See also Dr. Smith's more recent article in *Allbutt's System of Medicine*, viii, 38.

adds to the risk is climbing out of the depth, which is sometimes done by ladders. At St. Louis there were one hundred and seventy steps. If the men have to climb out it is better that this should be done in a tube in which the air is compressed to the same degree as in the caisson, or, better yet, an elevator should be supplied. On emerging from the lock the workmen should immediately lie down for a rest, and should take light nourishment, as beef tea or broth. Large, plethoric men do not bear the work as well as spare men, and men who habitually use alcoholic liquors should be excluded from this work. The physical state of the laborers should be carefully inspected, and cardiac and renal diseases, especially should be regarded as unfitting a man. No man should be employed who has passed middle life.

The regulation of the hours of labor is important, and these hours should depend upon the amount of pressure. The higher the pressure the shorter the shifts. When the pressure in which the men work is very high, as at St. Louis, a shift of two hours may be all that is allowable.

Ventilation of the caisson should be secured as well as is practicable. In former times when gas or candles were used there was much smoke and carbonic acid gas, and this led to the theory, already mentioned, that the disease was due to this gas. Although this theory is not tenable, there can be no doubt that excess of this gas is injurious and contributory to the risk. Electric lighting does away with much of this, but the air is, nevertheless, exhausted by breathing.

When the disease has once declared itself, recompression should be tried, if this is possible. It was strongly advocated by Smith, who said that the pains were promptly relieved by returning the patient into the compressed air. He advises that a special air chamber be constructed, to be supplied with compressed air, in which the patient could be placed on a cot. This suggestion has been adopted at the recent engineering work in the Hudson River tunnel.

Absolute rest in bed is, of course, essential. The intense pain demands relief, and nothing secures this so thoroughly, and controls some of the other nervous symptoms so well, as opium or morphine. A full dose of the latter should be given under the skin and repeated occasionally; these patients bear large doses well. I should think it might be supplemented with some of the coal-tar derivatives, such as antipyrin or acetanilid. The salicylates may also be used after the first acute pains have been relieved by morphine.

Smith thought that benefit resulted from the use of ergot, to which he was led by theory, as ergot is believed to control the circulation in the capillaries. He gave the fluidextract in dram doses, and saw prompt relief from pain. Ergotin can be given instead if desired. Theory might also suggest the use of adrenalin, although I have had no experience with it in this disease.

If the patient is very weak, with rapid pulse and respiration, as is sometimes seen even at the beginning, he should be mildly stimulated with alcohol and with strychnine hypodermically. Jamaica rum, or ginger, relieves the epigastric pain.

Dry cupping along the spine is indicated, especially over the lumbar region. Hot baths are said to have proved injurious. An ice-bag, well protected, to the spine is better. When coma is threatened, if the pulse is full and strong, venesection is recommended.

Bert, who believed the disease was caused by an excess of nitrogen gas in the blood, recommended the inhalation of oxygen, into which he thought the nitrogen would diffuse, but this advice has met with little favor.

For the resulting paralysis the patient should have rest, massage, electricity, strychnine, tonics, and good feeding, very much as recommended in these pages for lead palsy. If, however, the paralysis is of the spastic type, caused by a lesion above the lumbar enlargement, strychnine and even electricity may be contraindicated. A patient who has once suffered with this disease should never work in a caisson again.

Diver's palsy is a similar affection, and need not be described.

Food Preservatives.—These are best grouped all together for our purpose. They differ widely in their composition and actions, but I cannot undertake a chemical discussion of them. In their use, too, great difference prevails; and as to their unwholesomeness or otherwise, there is not a conformity of opinion. From time immemorial the common preservatives for foods have been common salt, nitre, vinegar, and wood smoke, but these call for no discussion here. It may be remarked, however, that even such a universal and so-called harmless preservative as common salt impairs the nutritive value of food, and may even be a factor in the causation of scurvy, and that if any one of the newer preservatives, such as salicylic or boric acid, had such injury fairly laid to its charge, the prejudice against it would be more rational than it is. The mere fact that a preservative is new is not evidence that it is injurious.

According to Leffmann the more important of the newer preservatives are salicylic acid, benzoic acid, sodium benzoate, beta-naphthol, saccharin, abradol, formaldehyde, fluorides, sulphites, boric acid, and borax. Some of these demand notice here.

Salicylic acid is used as a preservative in wines, preserves, and other articles, such as meats. In excess it would cause gastric disturbance, but there is little evidence from the medical standpoint that it has ever done great harm as used in foods. It is present normally in very small quantities in many fruits and vegetables.

Sodium benzoate is used as a preservative for catsups, jams, jellies, preserves, and mince-meat. Benzoic acid may be formed in these foods from the sodium salt. It is an active antiseptic, killing bacteria. In ordinary therapeutic doses, 10 to 30 grains, according to Wood, it exerts no perceptible influence, except to cause gastric irritation, with nausea and vomiting. As a preservative in foods it is present in much smaller amounts than these.

Beta-naphthol is also a gastric irritant, and if present in food in large amounts would act to disorder digestion. It is sometimes used instead of salicylic acid.

Saccharin has remarkable sweetening power, 220 times greater than sugar, and is used largely to take the place of sugar in confections and other things. According to Hare it escapes from the body unchanged and has no physiological action. Wiley thinks it is injurious to health when used to adulterate canned corn and peas.

Formaldehyde is used in a 40 per cent. solution, known commercially as formalin. It has a strong tendency to combine with proteids so as to form insoluble bodies. As a preservative in foods its action must therefore be deleterious, especially in meat and milk. This conclusion is supported by experiments on proteids and digestive ferments and by observations on young animals and children.¹

The sulphites, especially sodium sulphite and calcium sulphite, are used to prevent alcoholic fermentation, their antiseptic action being strongly exerted on yeast. They are also used as "improvers" of meats, and to bleach fruits, wines, and gelatin. They act as gastro-intestinal irritants if present in large quantities. They also disguise putrefactive changes, and thus do harm.

Boric acid and *borax* have been much used as preservatives, especially in milk, milk products, and meats, and much controversy has arisen about their effects, a controversy which is not yet ended. It is probable that they impair the nutritive value of meats, and they act injuriously by covering up putrefactive processes. Wiley thinks there is no doubt about the injurious character of borax as a preservative of meats.²

The evil effects of preservatives cannot be altogether stated in terms of chemistry. Foods thus treated may deteriorate in obscure ways, and be unfitted for use, and yet the chemist or the hygienist may not be able to state the exact reason for it.

There is, properly speaking, no therapeutics for these evils. The only remedy is prevention. If preservatives do harm, their use should be prohibited, and the only effective measure is regulation by law. The use of some of these preservatives raises a presumption against the food in which they are present, and the burden of proof should rest on those who so use them.

Alum.—Wiley says that the largest part of the baking powders now used contain alum in some form as the acid constituent. The usual form is the basic sulphate of aluminum. When the reaction takes place between this acid alum salt and the bicarbonate of sodium, which is the other constituent of the baking powder, carbon dioxide, which is the leavening agent, is liberated, and the residue consists of sulphate of sodium and the hydroxide of alumina. It is this residue of hydroxide of alumina that is of chief interest to the hygienist. If submitted to great heat it becomes a simple oxide, but whether the heat of baking will do this is disputed.

The manufacturers claim that the alum residue—the oxide—is insoluble in the gastric juices, and therefore can do no harm. Wiley

¹ Thresh and Porter, *Preservatives in Food*, p. 67.

² *Foods and their Adulterations*, p. 37. See also Thresh and Porter, *Preservatives in Food*, for diverse views on this subject.

grants that bread made with alum baking powders has no general effect upon the public health that is noticeable. But this, as he says, is not a valid argument in favor of these powders. In other words the burden of proof rests upon the man who puts an adulterant in human food. The time, perhaps, has not yet come to formulate definite conclusions about these powders.

Formerly the common, or burnt, alum was used. This is a sulphate of aluminum in conjunction with another base of sodium, potassium, or ammonium. But the hygienic problem, as I understand it, is much the same in either case, except that the claim is made, as already stated, that the hydroxide of alumina, which should be all that is left when the basic sulphate is used, is changed into an insoluble oxide on baking, and is therefore innocuous. If the common alum is used, some of the salt may not combine, and then it remains in the bread, and is more injurious than the hydroxide.

It is possible that the evil effects of these alum baking powders have been exaggerated, but nevertheless yeast is the best of all leaveners.

PELLAGRA

By H. F. HARRIS, M.D.

BUT little of value could be said concerning the treatment of pellagra if by the term we include only those melancholy and hopeless examples of *maize poisoning* that are observed toward its termination. The subject is one that is as yet so new in this country that few if any physicians recognize the milder types of the malady, only such cases being diagnosticated as present in a more or less pronounced manner, gastrointestinal, skin, and mental manifestations, for which, unfortunately, but little can be done. While it was, of course, inevitable that the classical examples of the disease should have been first recognized, the value of the discovery would have been but slight were it not that this information at once pointed out the most likely methods of prevention, and at the same time incited us to search in every possible direction for the incipient forms of the affection. Fortunately, the great Italian, French, and Spanish students of pellagra long ago recognized that it was possible in many instances, from certain symptoms pointed out by them, to diagnosticate the disease very early, and as practically nothing has been written in this country on this phase of the subject, and for the further reason that good results from treatment can only be expected at this stage, a short discussion as to the character of these manifestations and their relationship to treatment would seem desirable.

Accepting the theory—upon which practically all real students of the affection have agreed—that pellagra is the result of a chronic poisoning from the consumption, in one form or another, of spoiled maize, there is no room to doubt that the result is produced not by direct infection with animal or vegetable parasites, but as a consequence of the corn product containing within itself some toxic principle, probably the result of the previous activities of one or more low vegetable forms. In other words, the patient is poisoned much in the same way as he would be from the constant consumption of many chemical substances which are well known to be capable of setting up pathological conditions in the body, the character and extent of which would necessarily vary with the amount taken. Accepting the foregoing as being true, it becomes evident that we must necessarily have every grade of intensity of poisoning, from that which is so mild that no outward manifestations can be observed to others in which the full and most powerful effects of the poison are produced, and we find, as has been before stated, that the results of clinical experience bear out this assumption. We might then speak of the milder morbid conditions that result from the consumption of bad corn as being varying stages or degrees of maize poisoning,

reserving the name *pellagra* for only those extreme examples of the resulting pathological states that characterize the terminal periods of the disease. It is, of course, true that these stages cannot be sharply differentiated, since they insensibly merge one into the other, but fortunately they may be roughly divided in such a way as to serve every requirement from the clinical standpoint.

First Stage.—There seems good reason for the belief that the vast majority of those who suffer from maize poisoning never pass beyond this stage, and that those who suffer in this way probably constitute a not inconsiderable proportion of the entire population of the Southern States. The clinical manifestations are of such trifling character that they rarely cause the sufferer to demand the services of a medical man. On the other hand, the patient cannot be regarded as being entirely well. During the winter his health is, as a rule, excellent, but when the heat of the southern spring begins to cause fermentation in the corn products that he daily consumes, he complains more or less of malaise, loss of appetite, and not infrequently of a feeling of despondency, all of which vary from day to day. He not uncommonly suffers from what is called “biliousness,” has a furred tongue, and occasionally headaches. As the spring advances into summer he not infrequently complains of digestive disturbances, such as a heavy feeling in the region of the stomach after meals, the formation of gas, and very commonly heartburn. A curious burning sensation in the stomach, frequently extending up into the esophagus, is often complained of, the patient is apt to be dizzy, and has a feeling as though a lump were in the throat. Flurries of diarrhea are now and then encountered. The papillæ toward the end of the tongue are sometimes enlarged and quite red. During the summer the patient, as a rule, usually loses more flesh than is commonly the case. These conditions are apt to continue with varying degrees of intensity throughout the warm months, the patient again returning to a normal condition as soon as cold weather begins. Not infrequently these symptoms do not become prominent until the summer is far advanced, and may be even first noticed in the autumn.

It is, of course, obvious that no special treatment is indicated in a condition such as has just been described. It is true that more or less benefit may result from purgatives, particularly calomel, but relief of this kind would necessarily be only of a temporary character. Should the patient go to the mountains or to the seacoast—particularly where corn products do not play an important part in the dietary—recovery is usually rapid, and if the sufferer does not return home before cold weather begins he remains well until the following spring. If he be directed to leave off all foods prepared from maize, a similar result follows, as the writer can testify from numerous experiences. Drugs appear to exert no pronounced influence in permanently relieving the symptoms described, though patients frequently say that they are somewhat benefited by tonics, particularly those containing arsenic.

Second Stage.—The patient has usually suffered for a number of years in the way just described before he begins to complain of the symp-

PLATE XIII



Pellagrous "Mask" of the Face.

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toms that characterize a more advanced stage of the disease. Some spring, summer, or fall, after beginning in the usual way, the poisoning manifests itself more strongly than was the case before. The patient becomes very weak, particularly in the lower limbs, and has an indisposition to exertion of all kinds; this is the most common and most pronounced of all of the symptoms of moderate maize poisoning. Along with it we have, however, marked mental depression, and oftentimes slight soreness of the tongue, which comes and goes. The dyspeptic symptoms become now quite distressing, and periods of constipation, followed by diarrhea, are frequently complained of. The patient loses flesh along with his appetite, and often complains of curious abnormal sensations in the lower extremities, particularly a burning in the feet and legs. Hemorrhagic spots of irregular shape commonly appear on the backs of the hands and on the sides of the neck, to be followed by gradual absorption of the effused blood, frequently leaving a slight discoloration of the skin, which may be persistent for many weeks and even months. A close inspection will show in such patients what are clearly trophic changes in the skin of the hands and face, it becoming finely wrinkled, and having a parchment-like appearance. Pains in the abdomen sometimes occur. This degree of the poisoning may continue for long periods of time without the patient ever exhibiting the classical symptoms of pellagra. Sooner or later, however, in a certain proportion of cases, the affection becomes grave, and we find the patient gradually sinking into the more generally recognized later stages of the disease. In some instances when these symptoms persist for years, the sufferer finally acquires a persistent diarrhea, and which always, so far as I have been able to observe, leads ultimately to an unfavorable termination.

The treatment of this stage of maize poisoning consists above all things in at once prohibiting every food or drink that contains corn products, and a change to a cooler climate is of the greatest benefit. If the latter be impossible, the sufferer should be confined strictly to the bed, and should remain out-of-doors both day and night. Forced feeding should be practised, the patient being given raw eggs and milk to the point of toleration. On an average, six raw eggs and three quarts of milk should be allowed in the beginning, and both should be increased until at least a gallon of milk and ten or twelve eggs are consumed in twenty-four hours. As the patient improves, solid aliments may be allowed, but these should be gradually introduced into the dietary and given with the greatest caution, as digestive disturbances frequently follow the resumption of ordinary food. It is generally thought that arsenic is of benefit in maize poisoning, and it certainly can do no harm to administer it in cases of this kind, but I am constrained to say that I have never observed any marked benefit from its use. When the patient is treated in the manner described for six or eight weeks, recovery is the rule, and if he afterward abstain from all maize products a permanent cure results. It will be observed that the treatment advocated is in all essential particulars identical with that now generally practised for tuberculosis, and I would call attention to the fact that it has been

particularly successful in my hands, and, so far as I am aware, has not been heretofore suggested.

Third Stage.—This stage of maize poisoning is that which is called pellagra, and as its symptomatology is well known the treatment will be alone considered.

So far as I have been able to observe from a considerable experience, no drug may be said to exert any decided influence over this degree of maize poisoning. Arsenic, as advocated by the Italians, occasionally seems to be of some slight value, but that it exerts any decided curative effect appears to be more than problematical. The cases in which it seems to be of benefit are those that have a natural tendency to recover, as is usual in all those instances of the disease occurring in young and vigorous individuals—especially when they present the classical symptoms in their mildest form. In the severe examples of the malady, particularly when accompanied by nervous symptoms, I have never been able to convince myself that arsenic or any other medicine was of the slightest avail. When it is possible all patients presenting the typical symptoms of pellagra should take an out-of-door rest cure, if possible in the mountains, and should be fed in the same way as was directed in connection with the milder forms of maize poisoning. In such instances, if the disease be not too far advanced and the patient not too old, recovery may be hoped for when this treatment is followed, but there must always remain an unfortunate and not inconsiderable proportion of cases for which nothing whatever can be done.

Not only is the medical treatment of the disease as a whole decidedly unsatisfactory, but the various complications encountered during its course are but little amenable to drugs.

In the majority of instances the dermatitis requires no particular treatment, as after persisting for a few weeks the inflammation gradually subsides without the formation of sores. In other cases blebs form, followed by more or less superficial ulceration. When this occurs some protective application, such as oxide of zinc ointment or 2 per cent. boric acid in cold cream, favors the early return to a normal condition, but in spite of every remedial measure lesions of this kind sometimes persist for months.

Nitrate of silver solutions or argyrol are considered by some as being of value in the ulcerative processes that occur on the tongue, in the mouth, and on other mucous surfaces; although it does not seem to me that the influence exerted by these drugs is of a marked character, it is quite possible that recovery is hastened in some cases when they are employed. Antiseptic alkaline washes are soothing, but cannot be looked upon as curative in conditions of this kind. Like the skin lesions, those occurring on the mucous membranes have a natural tendency ultimately to get well should the patient survive.

Diarrhea, which is one of the most important and distressing symptoms of pellagra, shows but little disposition to be influenced by medication. Rest in bed and a liquid diet are of more value than drugs in its treatment, but we occasionally encounter cases in which artificial digest-

PLATE XIV



Atrophy of the Skin of the Back of the Hand
succeeding Pellagrous Erythema.

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ants seem to be of more or less value. As all pellagrous patients suffer from a diminution in the pepsin and hydrochloric acid normally present in the stomach, or even complete absence of these substances, a mixture containing them administered after eating sometimes promptly checks the diarrhea; however, the mouth and esophagus are often so sensitive that acids cannot be taken without great suffering, and this treatment cannot, therefore, in such instances be employed. When the patient cannot take acids other artificial digestants may be employed, and are occasionally followed by good results.

The mental symptoms of pellagra often foil every endeavor of the physician to successfully combat them, and not infrequently persist permanently after all other active evidences of the disease have subsided. Patients exhibiting mental disturbances are always the ones in which the prognosis is worst, and furnish a very high percentage of those that rapidly succumb. As soon as patients develop trouble of this kind they should at once be placed in an asylum, as it is only possible in institutions of this kind for them to receive the proper treatment. The physician should be especially warned against the use of narcotic drugs when nervous symptoms occur, as patients are apt under such circumstances to sink into a state of low delirium from which they sometimes never recover; even small doses of drugs of this class will often completely upset the mentality of pellagrous individuals.

It should never be forgotten that the principal lesions of advanced cases of maize poisoning are to be looked for in the central nervous system, where most extensive destruction of the brain and cord substance occurs—a destruction which is often so extensive that it is inconceivable that any remedial agent could in the slightest way affect the course of the malady.

EPILEPSY, TETANUS, AND CHOREA

By WILLIAM T. SHANAHAN, M.D.

EPILEPSY

EPILEPSY has been known to man for thousands of years, but from many aspects it remains as a sealed book to him, for, despite constant investigations, we must admit we cannot say positively what epilepsy is.

As to the probable cause of seizures in epilepsy, we are still in a position where we can but theorize. All manner of explanations have been brought forward to show how the seizure can be brought about, but the exact exciting cause we cannot at the present time determine. There is no doubt but the cause of some seizures has been found, but inasmuch as the complex depends on a wide range of underlying conditions from organic lesions and developmental defects to causes beyond our ken, it will be a long time before any considerable number of these causes can be definitely ascertained.

A moderately short and fairly inclusive definition of this malady under discussion would seem to me to be in the following: Epilepsy is a chronic, progressive disorder, with a symptom complex, characterized by recurrent abrupt seizures of impairment or loss of consciousness, with or without convulsions, and usually producing mental deterioration.

The hope of cure in epilepsy cannot be held forth to many, but an amelioration of symptoms, so that a much more comfortable existence is had, is possible in many cases.

The first fact to impress upon the patient and his relatives is that epilepsy is essentially a chronic disorder, thus requiring treatment over an indefinite period of years, perhaps, before positive results can be looked for when such are to occur. The patient must coöperate in every detail as to regulation of occupation, recreation, medication, diet, and general treatment.

These patients are too prone to consult a physician, follow his advice for perhaps a few weeks or months, then seek another practitioner, and so on over a period of years, ever seeking something which can alleviate their condition, not appreciating that a careful regulation of their every action is what is most needed.

The treatment of epilepsy is one requiring constant and careful effort along many lines. It is, when one considers the character of the condition, surprising that true epilepsy should be even ameliorated and in some instances arrested. By maintaining the control of the patient, a considerable degree of stability seems to be induced by an influence on the

nutritional processes, as a result of which the influence of the agent employed to control becomes firmly established, so that in the cases that are cured this agent can be discontinued.

The treatment of epilepsy should be prophylactic, ameliorative, and, where possible, curative.

It can be divided as follows:

(a) The prophylactic, or care of the neuropathic child, especially along hygienic and educational lines.

(b) The care and treatment of the epileptic at the onset and throughout the course of the disease by proper hygienic, dietetic, and medicinal means.

(c) Surgical treatment.

(d) Care in colonies, where the above methods can be followed out to the best advantage.

(e) Treatment of the special phases of the condition.

During recent years the study of eugenics has made rapid strides and aroused much interest throughout the civilized world. The intricate problems of heredity are far from being solved, but much light has been thrown on many phases of the subject. The transmission of forms of defectiveness from one generation to the next has been well established, particularly insanity, mental defect, epilepsy, and certain rarer nervous disorders.

The Mendelian theory has infinite possibilities in regard to the betterment, physically and mentally, of the human race, but as yet these are but possibilities. Sprigge, an English observer, is far from being convinced of the value of the medical certificate before marriage, as one of the chief planks of the eugenic platform, until the Mendelians have supplied the medical profession with more accurate knowledge of the workings of heredity upon which to base their decisions.

"Many individuals are born handicapped from the outset by physical and mental disabilities due to heredity, environment, and an upbringing which renders them unfit to wage successfully the battle of life. Such persons are a detriment to the nation to which they belong, and the most disquieting feature of the situation is that they apparently increase at a far more rapid rate than the better class of citizens. This brings about the tendency not merely to further degeneration, in itself sufficiently alarming, but, what is even more alarming, a deterioration of the general average. Many competent observers feel that in all parts of the civilized world the least desirable part of the population, from a physical and mental standpoint, is producing the more numerous progeny, and to them it would seem that, unless means can be devised to stay this flood of the unfit, in the course of time the entire race must descend to a lower level as regards physical and mental qualities."

Of the various methods which have been suggested for limiting the procreation of the unfit, the only ones likely to receive any large public endorsement in the present state of society, are (1) permanent segregation, or (2) castration. Permanent segregation of all members of the class we are considering is practically impossible, but the plainly defective

mentally should not be permitted to increase their kind. Whether or not surgical sterilization, in the form of vasectomy in the male and salpingectomy in the female, will become popular remains to be seen, but it is worthy of notice that the Indiana legislature in March, 1907, passed a bill authorizing the sterilization of confirmed criminals, idiots, imbeciles, and rapists in the State institutions in Indiana; since then more than 800 convicts have been sterilized. Connecticut, California, and other States have similar laws.

Lewellyn F. Barker's words ring clearly when he says, "If it be true that those born deaf and dumb, or feeble-minded, or with an insane or epileptic tendency, or color-blind, are likely to propagate their kind; and if it be true that the chronic inebriate, the prostitute, the drug habitué, and the habitual criminal are, as a rule, such because of the nervous systems they have inherited, and that they are likely to transmit defective nervous systems to their offspring, it would be desirable to educate public opinion, not only to discountenancing, but actually to legislative prohibition of parenthood for individuals so afflicted."

"In many States laws are passed for the permanent detention of inebriates, insane, the feeble-minded, and criminals. An effort is being made to prevent parenthood among these degenerate individuals by permanent segregation. The people are being educated better than before as to the significance of sex and the responsibilities of parenthood, of the dangers of racial poisons, and especially of the risks of venereal disease."

Imbecility, in certain of its forms, appears to be due to the absence of some definite simple factor. If two imbeciles marry, even though they be unrelated to one another, the offspring are all imbeciles. Epilepsy and imbecility go hand in hand, so the problem of preventing one is the same as for the other.

Walton and Carter, after careful study, decided that the chance of a given child with infantile convulsions becoming an epileptic in later life was only 1 in 222. They came to the conclusion that, unless epilepsy begins in childhood and becomes continuous, the child who remains free from infantile convulsions for a considerable period is no more likely to become an epileptic than any other individual.

Moon feels that a serious view must be taken of all convulsions occurring in infancy, especially if repeated. When the latter occurs, it is positive evidence of an abnormal brain and a distinct pathological basis for the development of epilepsy.

Koplik states that "Epilepsy is a true disease of the nervous system, and has nothing in common with, and no demonstrable relationship to, infantile convulsions." Holt also speaks of the two conditions being distinct.

Kerley believes that during the early days of life a convulsion is always a matter of serious import, indicating, as a rule, birth trauma, and suggests a possibly very serious brain lesion. We can agree with him in the statement that subsequent convulsions are more easily produced than is the first convulsion. Kerley believes that 10 per cent. of the cases

of epilepsy are the outcome of infantile convulsions, in many of which cases rickets plays an important etiological part.

I believe with those who maintain that no convulsion in childhood should be looked upon as of minor importance, no matter how prominent an exciting cause may be discovered. A single fit in childhood indicates the need for active treatment at once, and for close supervision thereafter.

The avoidance of convulsions in the young is of the utmost importance, as one convulsion may produce such damage in the brain as to leave behind a constant cause for recurring convulsions.

Simple attention to common-sense care of children will oftentimes prevent a life-time of misery and suffering. Prophylactic measures, to be considered in children, should be well tempered with good common sense. Children should not be permitted to become constipated, nor should they eat everything that comes in their way. The child apparently most healthy may, as a result of inattention to these matters, pass into a most serious condition.

For infantile convulsions, most writers advocate the placing of the child in a warm mustard bath or a mustard pack. The combination of a mustard pack and a hot foot-bath, continued until there is distinct red skin reflex, will often be found to be all that is necessary in the mild convulsion. If the convulsion does not rapidly subside, the inhalation of chloroform should be immediately begun. Whether there is a history of constipation or overfeeding or not, the lower bowel should in all cases be emptied by a cleansing enema, and later a cathartic given by mouth. Immediately following the emptying of the bowel, chloral and bromide may be injected per rectum. Three or four grains of chloral, and up to 10 grains of potassium or sodium bromide, should be given in this way to a child aged six months; in older children a larger quantity in proportion may be administered. The quantity of the injection should not be large, and it should be injected as high as possible, being prevented from escaping by elevating the hips and by tight pressure on the buttocks. This can be repeated within an hour if necessary. If the injection is not retained, or if the convulsion should continue in spite of it when the chloroform is withdrawn, another injection may be given, to which a small quantity of laudanum has been added. When the attack ceases, the child should be kept quiet for a few days, the bowels should be thoroughly evacuated and kept free, and a light diet should be administered. If the convulsions show any tendency to recur, the bromides should be administered.

McCarthy states that a hot bath or a hot pack is contraindicated in convulsions, complicating advanced pulmonary disease, with extensive disease or collapse, or when the fit is due to syncope. Careful search should be made for any abnormal conditions, and these should, if possible, be immediately corrected. The child thereafter should be most carefully watched, in an effort to keep its health to a normal standard.

M. G. Pearson points out that the usual long list of assigned causes for convulsions are not causes. Putting aside gross brain disease, one finds that in all cases of convulsions a high temperature precedes the fit

or is present at its onset. The convulsions cannot, therefore, be the cause of the pyrexia. Either the fever causes the convulsions or they arise from a common cause. The former has been found true in experimental convulsions produced in animals. By keeping down the temperature of children convulsions can be prevented, or, when they have occurred, can be cut short by reducing the temperature.

Pearson compares convulsions to the boiling over of a kettle; they are produced, and can be prevented, in the same way. For the control of the condition, he recommends the cold bath or cold pack. I have seen, as have numerous others, a marvelous improvement as to nervous symptoms wrought by the use of cold in the treatment of a pyrexia in children.

Pearson notes that a preliminary rise of temperature after placing the child into the cold bath was observed in some cases, showing a short bath to be useless. The duration must be regulated by the thermometer in the rectum. The colder the bath, the quicker it will reduce the temperature; shock must be considered and proper means of stimulation provided.

Those familiar with epileptics have often heard their patients state that, by influence of will power, they could cut short many of their seizures. The so-called aborted seizures are in all probability incomplete seizures, uninfluenced in any way by the mental effort of the patient. In other cases, however, it would seem that seizures are sometimes delayed when active mental concentration of the patient is required.

Knight truly says, "In some cases it would seem that there is a curious circumstance connected with the treatment of epilepsy. It is the effect of the mind on the disease. If the patient *believes* that he is to be put upon a course of treatment, under which he will recover, his fits will diminish in number, whatever the remedies prescribed may be, provided they are not absolutely injurious."

Romberg's statement is partly true, that "the strongest proof of the psychical influence is given in the fact that, even in inveterate epilepsy, the hopes excited by a change of physician and of treatment may prolong the intervals between the fits and even give rise to a pause." I infer that such results are largely due to the fact that each new physician is, for a time at least, more careful of the details of treatment, and thus gets the beneficial results often observed.

"In ancient times, epilepsy was treated by severe counterirritation, bleedings, purging, starvation, and such heroic mental remedies as a draught of blood fresh from a dying gladiator. The Hippocratic school and its later followers, Celsus, Galen, and Aretaeus, laid stress upon the value of 'a soft diet free from crudities' and regular exercise.

"The therapeutics of epilepsy, advocated for the one hundred and fifty years previous to the introduction of bromides, are most interesting and, in many respects, of much practical value.

"Great frugality and great exercise cure epilepsy, said Boerhaave. Tissot thought that cases of centric epilepsy which valerian would not cure were incurable. Dr. Benjamin Rush recommended sugar of lead. Schroeder van der Kolk was an ardent advocate of counterirritation

and scarifications. Graves cured several patients with *Cotyledon umbilicus*. Sir Thomas Watson said that in ordinary forms of epilepsy he would expect more from turpentine than any other single remedy. Herpin professed to have cured over half of 48 cases with oxide of zinc, but he subsequently pinned his faith more strongly to *Selenium palustre*. Skoda stated that the best remedy against epilepsy was belladonna, and Trousseau appears to have had greater faith in it than any other drug. Marshall Hall believed in the efficacy of small doses of strychnine, and, for certain forms of epilepsy, advocated tracheotomy. All early writers, from Hippocrates down, insist strongly upon the great value of diet, exercise, and baths, the opinions being that epileptics should live on a spare diet composed of soft and easily digestible food. These latter directions were laid down so carefully that they cannot be improved upon materially in our own day."

According to Dujardin-Beaumetz, "When Ballard, in 1826, discovered bromine, and the striking resemblances between this substance and iodine were pointed out, it was proposed to substitute the first medicament for the second, and it was in the treatment of syphilitic affections more especially that the substitution was made. From 1840 to 1850, in the Hospital du Midi, the physicians attached to this hospital, and in particular Ricord, employed bromide of potassium in the place of iodide of potassium. The first labors recording the result of this treatment, and showing the physiological and therapeutical properties of the bromide, were made by two internes of the hospital, Rames of Aurillac and Huette of Montargis. The thesis of Rames appeared April 25, 1850, and that of Huette several weeks later. These early investigations, while clearly setting forth the physiological, therapeutical, and even toxic effects of the bromide, made no mention of any application of the drug to the treatment of the neuroses, and in particular to epilepsy.

"The year following, Locock, taking up a discovery made several years before by a German, Otto Graf, who had noted in himself a marked depressant action following the use of large doses of bromide of potassium, and, in particular, sedation of the genital functions, for the first time applied these data to the treatment of hysteroepilepsy and of epilepsy, and out of 15 cases treated by the bromide, recorded 14 cures."

The bromides, used judiciously, are still without doubt our most potent agents in the treatment of epilepsy. Proper administration of the bromine preparations is very essential.

The history of the use of bromide in epilepsy, according to Gowers, is as follows:

"Bromide of potassium was introduced into the British Pharmacopœia in 1835 on account of its supposed value in the enlargement of the spleen. It was removed in 1851 as useless. In 1857, Sir Charles Locock advocated its use in epilepsy occurring in the menstrual periods. The first testimony of its service in ordinary epilepsy, accompanied, however, with iodide, seems to have been given by Sir Samuel Wilks, in 1861. A year later, Dr. Goddard Rogers published some cases successfully treated in the West London Hospital by bromide of ammonium, which Dr

Duncan Gibbs had been using for some time to lessen the sensibility of the throat. Dr. Panskill, early in 1863, published a single case treated by bromide of potassium at the Queen's Square Hospital, and it seems to have been constantly used there through that year by himself, Dr. Radcliffe, and Dr. Hughlings Jackson. In February, 1864, Dr. McDonnell advocated its use in epilepsy, and he has been associated with Locock as deserving the credit of its discovery, but he had evidently been anticipated. After this date records become abundant. No earlier observations seem to have been made abroad."

According to H. C. Wood, upon the cerebrum of higher animals the bromides undoubtedly exert a depressing influence. Albertoni found that, when administered to dogs, the bromide depresses very markedly the power of the motor zone of the cerebral cortex to respond to stimuli and to give, therefore, on decided irritation, epileptic discharges. It was also discovered that this action of the bromide was much more decided when there had been a prolonged saturation of the system with the drug than after a single large or even toxic dose.

Prus, Hering, and Rossi have demonstrated that the local application of bromide to the cerebral cortex of animals makes impossible, or very difficult, the artificial production of epileptiform seizures. This, of course, shows that the bromides diminish cortical irritability, which action no other drug used in the treatment of these conditions possesses. Therefore, the portions of the human organism most sensitive to its influence are the whole cerebral cortex, the receptive side of the spinal cord, and the afferent peripheral nerve-endings. Whether the tissues of the nervous system, especially the brain, possess a special affinity for bromine has not been positively determined. Whether or not the action of the bromide as a vasomotor depressant is partly the cause of its beneficial effects obtained in the treatment of epilepsy is still open to question.

The bromide in one form or another has done more to control the epileptic seizures than any other drug that has ever been used. It is, however, a drug that has to be used with caution, and the patient kept under constant observation in order to prevent deleterious results. Half an ounce of the bromide has been given at once without noticing serious symptoms, but, under ordinary methods of administration, dosages small at first—5 grains three times a day—should be prescribed, and then increased gradually until the limit of tolerance is reached in the individual case. In all administration of the bromides they should be well diluted. In some cases the bromides may cause diarrhoea, but these are exceptional.

An important fact to remember is that, in order to obtain any beneficial results from the use of bromides in epilepsy, they must be administered continuously over a long period—perhaps years.

The different bromides may be given singly or in combinations, all to be well diluted, as before mentioned.

It may be stated that the development of a severe acne during the administration of bromides indicates an excessive dose or lack of attention to the excretory organs, particularly the bowel and skin.

Bromides may be given in milk. They should, when given for effect on seizures at some particular time of day be administered several hours previously, owing to their slow action.

It is important to note in the administration of bromides that they are cumulative in their action. Attacks may not be at once arrested, but may cease gradually in the course of two or three months' administration, but, for the continuous administration of bromide, the minimum dose that is effective should be employed, this naturally varying in the individual case. The best results obtained are by maintaining the minimum dose over a long period of time, watching carefully the general state of health of the individual under treatment.

It is claimed that arsenic, when given with the bromides, will prevent the development of bromism; but, in addition to this, experience has taught us that careful attention to bathing, diet, condition of the bowels, etc., is even more important than the use of the arsenic.

Fuchs has shown that the effect of the administration of the bromides can be gauged by the difference in the behavior of the reflexes with a cortical lesion in one hemisphere. The reflexes on the side affected become abolished under the influence of the bromide, while they persist unmodified on the sound side. This reaction of the bromides was pronounced in 18 out of 21 cases of epilepsy with hemiplegic symptoms. For example, a boy with right hemiplegia had the superficial abdominal reflexes alike on both sides. Forty-five minutes after ingestion of 1.5 gm. (22 grains) sodium bromide the abdominal reflexes on the affected side were abolished and the Babinski positive, while on the sound side there had been no change in the reflexes. This behavior of the reflexes was striking in 6 cases, as he relates in detail. In the remaining 59 cases of epilepsy, little, if any, benefit was derived from the bromides. There was nothing in these cases to indicate a cortical lesion.

Hughlings Jackson suggested many years ago that the efficacy of the bromide salts might be due to their replacing with greater energy the more common chloride salts. Toulouse and Richet are the first reported as having made practical application of this suggestion, by substituting sodium bromide for sodium chloride in the food. This method of salt starvation has been extensively tested with varying results.

Hypochlorization, used in conjunction with bromide treatment, lessens the amount of bromide which has to be administered. In order to carry out this method of treatment satisfactorily, the patient must naturally be under close supervision, to secure the proper preparation of food, and to prevent the patient from procuring sodium chloride surreptitiously.

The consensus of opinion at the present time is that this method is of much aid in securing the fullest effect of the bromide with the least injurious influence on the general health.

Because of the results of hypochlorization, it has, for many years past, been considered that sodium chloride was contraindicated in epilepsy. A. Ulrich has found, however, that the symptoms of bromide poisoning rapidly subside when sodium chloride is given internally;

the motor symptoms especially yielding at once to the action of the salt. He states that bromide acne is also rapidly cured by local application of a 10 per cent. sodium chloride solution, thus suggesting that sodium chloride is the antidote of bromine. He also reports that he was able to bring on an epileptic seizure in 12 cases of genuine or Jacksonian epilepsy, by giving 20 to 30 grams (300 to 450 grains) of sodium chloride daily for a short period for diagnostic and therapeutic purposes. It would seem to me that this latter conclusion requires considerably more proof before it can be generally accepted as a fact.

W. A. Turner finds Gelineau's formula most useful and satisfactory. It is prescribed in the form of dragées, containing 1 gram (15 grains) of potassium bromide, $\frac{1}{8}$ milligram ($\frac{1}{200}$ grain) of picrotoxin, and $\frac{1}{2}$ milligram ($\frac{1}{20}$ grain) of the arseniate of antimony. It is said to be much used in France. The picrotoxin is theoretically supposed to lessen the tendency to cerebral vasoconstriction, which is by many believed to be a fundamental factor in the causation of epileptic fits.

An emulsion of bromine, called bromipin, prepared with bromine and sesame oil, is used to a considerable extent. Merck claims that 30 grains of bromipin are equal to 15 grains of potassium bromide. This bromipin solution may be diluted with the mucilage of acacia, etc., so that it may be used in any strength desired. The different bromides may be given hypodermically if prepared in a sterile solution, although sometimes, despite every care, suppuration and necrosis of tissue occurs at the site of injection. Brometone, brovalol, sabromin, etc., are used in the treatment of epilepsy as being more elegant preparations than the ordinary bromides. In my experience at the Craig colony they have not proved to be sufficiently valuable to warrant their use, to the entire exclusion of sodium bromide. They are supposed to be less liable to produce skin eruptions, depression, etc., than the ordinary bromides. The high price of these preparations precludes their use to any great extent except among the wealthier classes.

Kurt and others advise bromoglidine, a compound of bromine with vegetable albumin, as not producing the marked mental effect resulting from long use of the metallic bromides.

Turner advises using hypochlorization with a purin-free diet. This latter excludes meats, and lessens quantities of most forms of fish, peas, beans, tea, coffee, and oatmeal. Turner has used this purin-free diet, or a modification of it, according to the needs of individual cases, in conjunction with the bromides, and advises it in all recent epilepsies.

The discovery of the action of calcium salts on the cerebral cortex, and their application in the treatment of epilepsy, we owe to the researches of several Italian investigators. One of them found that soaking the cortex in a solution of calcium chlorate diminished its excitability, while such salts as sodium oxalate or citrate have an opposite effect, and came to the conclusion that solutions of calcium salts in the circulation are an important factor, if not in the causation, at least in the continuance, of epilepsy.

Some investigators have found that the coagulability of the blood

in epileptics is diminished as compared to that in a normal individual. This was found to be true in a series of cases examined at the Craig Colony during the past year. John Turner failed to find diminished coagulability of the blood as other observers have reported. It is possible that certain selected cases of epilepsy may be benefited by the administration of one of the calcium salts. Littlejohn, Turner, Ohlmacher, and others have reported beneficial results from the administration of calcium salts in epilepsy. In a series of cases treated at the Craig Colony during the past year we have failed to obtain the beneficial results reported by the last-named investigators. Donath has had a similar experience to that obtained at the Colony. It is a well-known fact that cases of tetany, which are apparently due to some interference with the parathyroid glands, are relieved entirely by the administration of calcium salts. Whether there is any connection between any phase of the epileptic seizure and the symptoms of tetany is, of course, as yet unknown.

I administered parathyroid extract to a woman with myoclonus epilepsy over a period of nearly a year, but obtained no noticeable improvement in her condition. Further investigation along such lines might, in carefully selected patients, prove of value.

Although, as a rule, it is proper to control the seizures by sedatives, while every effort is being made to place the general health in the best possible state, we occasionally find an epileptic having an infrequent seizure, following which he feels much improved for a time.

Charles E. Atwood writes that, although it has long been recognized that syphilis plays an important role in the causation of idiocy and the arrest of brain development, the exact percentage could not be ascertained until the Wassermann test made it possible, since which definite positive serum reactions have been found in idiocy, imbecility, epilepsy, dementia præcox, and nearly all cases of general paresis. He notes that the reaction had not disappeared even at so late a period as the ages of thirty-four, thirty-five, and thirty-seven in 3 positive cases; also, that stigmata of syphilis appeared in only 4 of the total 30 cases with positive serum reaction. The percentage of positive reactions found was much greater, in proportion, in idiots with superadded gross organic brain defect than that found in idiopathic idiocy.

He makes the suggestion that "Every case of idiocy should have a serodiagnosis test to ascertain whether syphilis is a factor in its etiology; and something might also be accomplished, in the way of prophylaxis, as suggested by Lippmann, by applying the test to pregnant women in the lying-in and gynecologic hospitals. The importance of this suggestion is enhanced by the statement of Baisch, that in women three-fourths of the cases of syphilis are latent. In other words, Baisch obtained positive seroreactions in women, three-fourths of whom presented no clinical evidence whatever of syphilis. Aside from the opportunity of treating the mother, an inunction cure of the infant after birth is often attended by striking success. Many cases of marked improvement are on record in which the mercurial treatment of mental defectives was

employed. The indiscriminate specific treatment of all cases of idiocy, as in some cases of the clinics abroad, without a careful preliminary blood test in each case, can scarcely be recommended, as the use of mercury or of the iodide, when not directed with a definite purpose, is capable of considerable harm, on account of conditions of malnutrition in the little patients."

Inasmuch as mental defect and epilepsy go hand in hand, it would seem that much might be done to investigate further, with possibility of some light being thrown on the etiology and therapeutics of epilepsy.

Senile epilepsy includes those cases which occur in the period of life when physical decline has already begun to show itself. The underlying etiological factor is arteriosclerosis, occurring usually in men who, as a rule, have been active in business or professional life. Preliminary symptoms may be slight or unnoticed until an epileptic attack takes place, perhaps following an exhausting day's work or a heavy dinner. According to observers, the arterial tension just preceding the attack becomes very high, and is apparently the exciting cause of the seizure.

This condition may occur in those free from such a history. The course of the disease varies with the course of life followed by the patient after his first attack. The succeeding attacks recur with varying degrees of frequency, and in the intervals the symptoms, other than other common senile changes, are not marked. The general tendency of the disease is toward dementia or premature senility, frequently accompanied by depression. The arteries involved are probably cortical, and the attacks, no doubt, due to temporary occlusion of the vessels—possibly to venous stasis. There may be a localized serous effusion, but this shortly clears up, leaving no trace of paralysis or other impairment. The seizures are at times very severe, and, in fact, may end in cerebral hemorrhage of the usual type.

The treatment of this type of seizures is that for arteriosclerotic changes in the cerebral vessels, viz., careful regulation of diet, exercise, sleep, and use of remedies to keep the blood-pressure near the normal height.

Spratling years ago stated that "We can, and must in many cases of epilepsy that appear during the twelfth to the sixteenth and eighteenth years, coincident with the establishment of the *menstrual flow* in women, and with the development of adolescence in the male, ascribe to these changes the power of inducing well-defined convulsions that may be epileptic.

"Such periods cannot in the normal person induce epilepsy. Careful inquiry usually shows a pre-existing tendency toward convulsive phenomena."

Gordon selected a group of epileptics, all of whom were subject to great exacerbations of the attacks at or about the menstrual period. Some days before the period Gordon administered thyroid extract to these patients, and noted very gratifying results. "This agrees with the theory that the ovarian secretion inhibits the activity of that of the thyroid, since, in these patients, it is probable that there was excessive

ovarian secretion, which was opposed by the use of the thyroid extract. Taken altogether, the question of the interrelation of the ductless glands and the nervous system is one of absorbing interest, and seems to hold within its grasp the solution of many of the problems of physiological and pathological activities."

Careful observations, made over a long period on a series of 200 female patients at the Craig Colony who were menstruating regularly, showed that in 181 there was no apparent change in the phenomena of the epilepsy at the menstrual periods. In 13 cases, seizures of petit mal type were somewhat more frequent than during other parts of the month. In 4 cases the seizures occurred just before or at the end of menstruation; in 2 cases the seizures were less frequent than at other times; 28 cases showed some mental disturbance occurring at the time of the flow, but whether any relationship existed between the two conditions is open to question, as in most of such cases these changes also appeared at other times than during menstrual periods.

One patient had a monthly average of five seizures, some grand mal, some petit mal. Her menses ceased for five months without ascertainable cause, and her attacks did not appear. Her menstrual periods then returned, and she had a monthly average of seven seizures. The seizures were not grouped at the time of the month when the menstrual flow took place.

Observations made on other series of cases cannot but make one feel that the relation between the symptoms of epilepsy and menstruation is not as intimate as Gordon and other writers would have us believe.

The proper correction of errors of refraction and muscular imbalance removes a source of irritation in the individual, and may thus ameliorate his condition to a marked degree. Ophthalmologists of standing report from time to time cases of cure of epileptic symptoms as a result of proper attention to the eyes. Dr. Arthur G. Bennett advises me that he has had one such case remain free from seizures for fifteen years. She wears her glasses constantly while about, only removing them after she has gone to bed at night, and replacing them before arising in the morning. He has seen other cases remain free for a shorter period.

With the constant effort required to overcome a marked astigmatism, defect of vision, or strabismus, there must necessarily be a constant strain on the cortical cells to meet the demands of the condition. It is easy to believe that such irritation can possibly incite discharges from any or all of the unstable cells of the epileptic with which it has communication.

In this condition, as in all others, there must be a careful individual treatment. General rules of treatment are applicable to all epileptics, but special modifications must be made for the individual case if favorable results are to be obtained.

I feel that every epileptic, when he first comes under observation, and later if indicated, should have an ophthalmoscopic examination made, visual fields and color vision tested. Cushing lays stress on inversion of the color fields alone often appearing as an early symptom of brain tumor.

High-frequency, high-potential electrical currents are claimed to act as a nerve sedative, to control local congestion, and to promote the normal functional activity of the nerve centres, thus affording itself to be utilized in the treatment of epilepsy.

Upon the theory that Roentgen rays stimulate protoplasm into greater vital activity, this remedy has been used in cases of epilepsy, a different part of the skull being exposed at each sitting. Beneficial results have been reported, but it is not now so used to any extent.

The influence of intercurrent diseases on epilepsy has long been noted—*e. g.*, pneumonia, measles, scarlet fever, malaria, and other diseases not infrequently serve to check all epileptic manifestations. This cessation of symptoms may continue for months, but is seldom, if ever, permanent. Some years ago there were those who advocated exposing the epileptic to these diseases for the purpose of relieving his condition.

Among other important measures to be borne in mind are hydrotherapeutic measures, such as Russian and Turkish baths, Scotch douches and cold showers, which are of value in certain cases for their tonic and eliminative effect. (This, by the way, is an old remedy too little employed.) Sweating in the steam-cabinet, followed by a cold shower and a brisk rubbing, is excellent in most cases. Always select with care your cases for hydrotherapy, taking due precautions in those with heart lesions.

Where a blood examination reveals a diminished amount of hemoglobin and red cells, use iron, cod-liver oil, good nourishing food, fresh air, and proper exercise to overcome the condition. Many epileptics suffer from poor peripheral circulation. Warm baths, massage, and proper exercise are required to overcome this. Baseball, lawn-tennis, croquet, walking, running, and football will afford healthy recreation.

So far as school work is concerned, the results are not, as a rule, very encouraging, for the reason that many patients, as a result of a seizure, lose the facts just learned and the entire lesson must be repeated. The great advantage, however, in pursuing ordinary school branches is the mental training along lines of discipline.

The relatives of the epileptic child are kept in a state of constant anxiety and dread, and the patients themselves are frequently so confined and deprived of liberty that it is not surprising that their mental status is below par as a result of this as well as because of the epilepsy. Special institutions are established for the purpose of giving these sufferers as much liberty as is possible, and to occupy and train them along different lines.

The epileptic child is often allowed free rein, and consequently their education has suffered. Those whose mentality permits educational pursuits are neglected, as a rule, and not taught the simple things possible for them to learn.

After a seizure the knowledge gained previously may be completely swept away. Reëducation is a slow, difficult, and irksome process under such circumstances, and requires to be intelligently carried on by teachers who are capable of exercising much patience and forbearance. The

poor memory, is as a rule, a great handicap to the epileptic at school. Slow and progressive instruction is what should be striven for. Reading, writing, spelling, simple arithmetic, and grammar are sufficient. Deleterious results usually follow efforts to push instruction beyond these subjects. Of course, an occasional epileptic has a marvelous ability to pursue higher mathematics or some other subject, but these cases are exceptional.

Proper educational work seems oftentimes to have a beneficial effect on the mental status of the epileptic child. It appears to prevent deterioration manifesting itself, as it is a well-known fact that mentally defective children and adolescents, unless occupied in some way, deteriorate much more rapidly than do those who have regular pursuits planned out for them.

It is the exception that proves the rule to find an epileptic in whom there is not some weakening of the mentality. Because of this, all require some controlling influence which will exercise a careful supervision over every detail of their daily life.

The presence of epilepsy usually creates sympathy for the afflicted one in the family, and sympathy tends to aggravate the disorder, either through the person's being granted improper privileges of many kinds or by virtue of the fact that the epileptic is a "skeleton in the family closet." The unfortunate individuals are kept in the background, debarred from ordinary comforts and privileges. Not infrequently an epileptic child in a family is a menace to the physical safety of the other children in the family, and for this reason, if for no other, an epileptic of tender years or defective intelligence, or both, should receive institutional care, unless the family is in such circumstances as to enable them to employ a special attendant to care for the sick individual.

The care of epileptics in special institutions has developed rapidly during the past twenty years. At the present time there are numbers of these scattered through the various parts of the civilized world. Delasiauve, writing early in the last century, advises as indispensable the establishment of institutions for the reception of epileptic patients, in order that a hygienic as well as medical plan of treatment may be carried out.

Dr. W. P. Spratling, some fourteen years ago, stated, "If epilepsy has, or is based upon, a single essential condition that consists in a periodic liberation of dissipated energy, that tends to perform no preconceived physiological act. All other conditions or symptoms that follow this, not excepting the chief attendant one of disturbed consciousness, are of secondary importance." It was his belief that certain epileptics expend, through the medium of legitimate labor, surplus energy that otherwise might be expended in a convulsion. The exercise of muscle means the exercise, growth, and development of brain-cells that control such muscles. Not only can surplus energy be gotten rid of in this way, but in the end the cells of the brain acquire a greater degree of resistance to abnormal stimuli and irritants.

Exercise causes more blood, laden with nutritive elements, to flow to the cells. Likewise the debris, which under such conditions is more

rapidly produced, is more rapidly carried away. The exercise of muscle and brain for the epileptic is thus of special value. Nearly all of his kind suffer from a lack of coördination of the finer muscle movements, and his sensory apparatus is notoriously liable to suffer maladjustment.

Work is essential in the treatment of epilepsy, but the work should be selected with all possible care, so as to provide sufficient muscular exercise combined with fresh air. Vigilance should be exercised to avoid putting the epileptic at occupations which would necessitate his being in places unduly dangerous, especially when he has no aura, or one which does not occur sufficiently early so as to allow him to reach a place of safety. The hours of labor should not be of such length as to fatigue the patient beyond a degree which will create in him a demand for sleep of a normal period and recreation of a proper kind.

All epileptics whose mentality is not too much below the normal are much better, both physically and mentally, when obliged to follow some regular occupation. This work may not be of any great monetary value, but it is a form of treatment necessary to keep the patient in the best possible condition, both physically and mentally. Some epileptics can perform as much work as a normal individual, except at the time they have their seizures; but of the epileptics seen in an institution, patients of this type are comparatively few in number.

To arrange the life of such an individual so as to have him pursue some definite occupation is a task requiring tact, patience, and perseverance. It must be impressed upon the patient that such an occupation is for his own good. Not only is it necessary to explain this matter to the patient, but oftentimes to his relatives, who have an idea that work of any sort is not to be allowed in the treatment of epileptic patients.

After the majority of the epileptics, who have not deteriorated too much mentally, have pursued a regular occupation, they feel as if they were not following out a proper line of treatment if anything arises to prevent them from conducting their work.

Such a line of occupation is far more important in its results than many courses of medical treatment that may be prescribed. Not only is there oftentimes a physical improvement in the individual, but also a mental, for the reason that he is forced to regulate his thoughts and ideas along certain channels in a more orderly manner than he has ever been accustomed to previous to the time of his being placed under closer observation. A hemiplegic oftentimes can accomplish a considerable amount of work, despite the fact that he is unable to use but one side of his body.

The incompetency of the majority of epileptics, so far as accomplishing a full day's work is concerned, is generally conceded.

In an institution for epileptics the patients must be graded according to their ability or capacity to carry on different kinds of work. Some must be placed at simple work requiring but a few hours' effort during the day, others can be placed at ordinary occupations, and be physically able to pursue such work as long as the average healthy individual can.

Of utmost importance in directing work is the character, skill, and judgment of the attendants in their directing of the efforts of the patients.

We are oftentimes asked as to whether the bringing of a large number of epileptics together does not have a bad influence on the individuals thus brought in contact with one another. Our experience has been that apparently there is no great effect produced because of one patient witnessing the seizures of another. This influence, generally believed in by the public, has been largely exaggerated.

The discipline acquired by persons living in a community of this sort is often of great use to them, for the reason that epileptics in particular have been allowed to do about as they pleased before entering an institution. In consequence of this, their condition is oftentimes materially worse than it would have been if they had been forced to obey some definite rules of living. The routine life, the reasonable restrictions, and proper self-control enforced by regulations are of greater importance to an invalid of this sort than is the ordinary medical treatment.

Flood truly says, "In order to have knowledge of epileptics, so as to treat them properly, several kinds of experience are needed; one must see epileptics individually, treat them in attacks, watch over them in *status*, associate with them when at their best, see them in masses under all their conditions of life, manage their general modes of life, arrange their work and their play, see them in anger, know what motives act upon them, and be their friend."

A brief *resume* of the present methods of care and treatment of epilepsy is as follows:

Proper diet, hygiene, and occupation are the three great essentials to be considered first in the treatment of epilepsies, as in many other of the maladies to which the human race is a victim. After these have been gone into thoroughly and readjusted when necessary, then comes the question whether or not medicinal treatment is required.

Under diet should come first the examination of the various secretions and excretions, to ascertain if evidences of an abnormal state are present. The gastric and intestinal digestive powers should be examined into most thoroughly. The urine and feces must be investigated. These examinations will bring to light errors in metabolism, which, in all probability, are, when combined with the hypersensitive nervous system (cortical substance), in many cases the cause of the occurrence of seizures.

If these faults of secretion and excretion can be corrected, and as a result the fermentations, formation of ptomaines and toxins prevented, and better elimination brought about, we will be in a position to control to a great degree the poisoning of the cortical substance, and so bring about the cessation of seizures due to autointoxication, which many deny exists, but which, to my mind, is an active agent in exciting especially serial seizures and *status epilepticus*.

Epileptics should avoid alcohol as their worst enemy. With their hypersensitive nerve-cells it often acts as the spark to the magazine.

A simple diet, varied as much as possible within certain limits, is all

important. A plentiful allowance of fresh fruits and vegetables (excluding cabbage, especially when cooked), butter, cereals, milk, eggs, fresh beef, mutton, fowls, etc., but not veal or pork. Above all, no alcohol, pastries, cakes, rich fried foods, or condiments in excess. Special care must be exercised to see that all articles of food are of good quality, fresh, and properly prepared before being used. Special claims have been made for buttermilk as overcoming intestinal fermentation, etc. Its use at Craig Colony has not shown it as bringing about any material reduction in the number of seizures.

Cornell, writing fifty years ago on the treatment of epilepsy, states that "in the first place, an absolute control must be maintained over the *diet*. The reason that more cures are not performed is that neither physicians, patients, nor their friends, will pursue that course as it respects *diet*, which it is absolutely necessary to pursue. I lay it down, then, as an absolute law, as fixed as 'the laws of the Medes and Persians,' or as any part of Napoleon's dynasty, that the patient must comply with the prescription of the physician, as it respects *diet*. Unless this is done, but little benefit can be expected from medical treatment."

We, at the present day, can but concur with Sieveking, that "An impaired state of the digestive powers is frequently associated with epilepsy, and the regulation of the diet of the epileptic is an important indication, which applies to all, but to none so forcibly as to children. But though a predisposing influence may occasionally be traced to continued insults being offered to the stomach, still this cause cannot rank higher than almost every other influence which carries with it a debilitating effect. Dyspeptics may be counted by the thousands, while epilepsy can only number its victims by units."

This still remains a moot point, and to settle this question we might apply the autotoxic theory; but it seems generally accepted that a satisfactory mode of examining the metabolism of epileptics has yet to be discovered.

The principle involved is to give only as much food as the patient can easily digest and assimilate, and to allow sufficient time to elapse between feedings to permit the patient to properly utilize and excrete the end-products which he does not assimilate. When this is not done, attacks are often provoked by the accumulation of irritating substances in the bowels, by the absorption of toxic substances from the intestinal tract, or by the accumulation of products of metabolism in the body.

Milk, cereals, and fruits are useful in children, although care must be exercised to avoid indigestion by using too much milk. For hundreds of years a milk and vegetable diet has been recommended in epilepsy.

The quantity of meat should be restricted for all epileptics irrespective of age. Rosanoff, as well as many others, claims to have reduced the number and frequency of seizures by giving a lessened meat allowance. He, after dietary tests, concluded that the epileptic patient should receive the largest amount of carbohydrates and fats that he can assimilate without inconvenience, and the smallest amount of proteids which is compatible with the preservation of the nitrogenous equilibrium; that is

to say, the amount of nitrogen ingested with the food must not be allowed to fall below the amount excreted.

At the Craig Colony we allow, not to exceed seven ounces of meats or fish daily for workers, and four ounces daily for those not employed.

Eating slowly and masticating the food well are of utmost importance. The avoidance of constipation is of primary importance, and can be, as a rule, avoided by proper dietetic standards.

As has been pointed out by Chittenden, many individuals unquestionably live on a too high protein diet, with the result that the nitrogenous waste-products are increased, unnecessary labor is thrown upon the excretory organs, and the very best opportunity given for the growth of putrefactive bacteria in the intestines. In such derangements of the intestine attention should first of all be given to the diet. Two other important factors are proper motility in the alimentary tract and efficiency of the digestive juices.

We now question the possibility of our being able to give a high enema by use of a long tube, which invariably curls on itself. Elevation of the hips, and the use of an ordinary rectal tip, will usually enable one to wash out the bowel very satisfactorily. Oil lavage is useful for spasmodic constipation and oil enemata for low constipation. A mild, non-irritating laxative of value is fluidextract of cascara sagrada, gtt. 5 to 10 daily, increased to half a dram, until movements are soft and regular, then diminish the dose. Regulation of the diet and regular going to stool are of the utmost importance in overcoming the constipation so commonly seen in epileptics. An occasional calomel and saline purge should be given as indicated.

After tests, extending over a period of over three years, Baugh concludes a purin-poor diet, although often the best for good general health, does not always mean fewer fits; some seem to have more fits. He states that on a diet mainly purin free tendencies to serial fits, confused states, and dream states appear less marked. He finally arrives at the opinion that, when the epileptic is taxed with a diet average or rich in purin, failure of the organism to carry out metabolic functions plays a considerable part in the production of symptoms.

Overfeeding as well as feeding of improper food must be avoided in the epileptic of every age. An unnecessary residue in the intestinal tract often furnishes deleterious substances for absorption into the general system.

The epileptic should eat slowly, masticating his food well, he should be moderate and exclusive in his diet, and he should not eat between meals nor just before retiring.

In Lerch's opinion, the aim of the diet must be to reduce the blood-pressure, as well as to prevent the formation of toxic substances which increase the pressure and also irritate the centres and all the tissues and organs of the body.

Tea and coffee must be used in moderation and should be weak. Lalemant and Rodiet report, after thorough study, that an essentially vegetable diet, with which coffee is accompanied, brings about a marked

increase in blood-pressure. For that reason they feel that coffee is to be avoided in epileptics.

The tendency to consume great quantities of food and drink is very marked in a large number of epileptics. I have seen patients who after having at a meal three large cups of coffee and two large plates of well-prepared food, in addition to several slices of bread and butter, complain of their food supply being entirely too limited.

We should remember that the gastro-intestinal tract's impaired function, so common in epilepsy, is probably closely related to, and perhaps a part of, the general defective development of the individual.

Smoking in moderation cannot, in my opinion, have an injurious effect on the average adult male epileptic, especially when he has been accustomed to it for many years.

The treatment of the patient during the seizure consists in placing him, when possible, in a position so that no injury will be received as a result of the convulsive movements, the placing of something between his teeth to prevent the tongue biting, the loosening of any constricting bands about the throat which might interfere with breathing, and giving, so far as possible, a free entrance of fresh air to the patient during and directly after the seizure.

The aborting of a seizure by tying a ligature about the part in which the aura is first felt—for example, the hand—has not, in my experience, produced the results claimed for it. Attempts to voluntarily inhibit seizures have been reported frequently, and many claim to be able to abort seizures by tying cords about extremities, by swallowing a little water, by placing a pinch of salt in the mouth, etc. It may be that concentration of attention may cut short a seizure, but I have always been of the opinion that these cases of so-called aborted seizures were incomplete seizures, with simply the added incident of an attempt to cut short the attack.

For serial seizures and status epilepticus, chloral hydrate must be used. The treatment of status should, however, be in most cases prophylactic. If a patient's emunctories are kept active, and not allowed to grow sluggish, you can, in many cases, prevent, or at least abort, a status period. If once established, emptying of the lower bowel should immediately be resorted to and chloral hydrate given by enema, retention of which should be aided by laudanum. It should be used with caution, and exhaustion guarded against by the use of stimulants, such as aromatic spirits of ammonia, enemata of strong black coffee at a temperature of 100° to 105° F., and normal saline solution by hyperdermoclysis, enema, or intravenously. Oxygen may be useful; also strychnine, digitalis, strophanthus. Chloroform is useful in acute status to control seizures until chloral hydrate can be given by bowel and be absorbed. This latter method will, in many cases, cause a complete cessation of seizures. Gastric and intestinal lavage at the onset is often of value. A careful watch must be observed for pulmonary cedema and pneumonia. Venesection is of value in plethoric cases. Hot packs have seemed to have acted favorably in some status cases. Amylene hydrate, dormiol, etc.,

may also be used as antispasmodics. The bromides and amylene hydrate have been used hypodermically in status epilepticus, but with questionable success. Local tissue necrosis, at the site of injection, usually occurs as a result of such treatment.

Personally, I have seen little or no benefit in status epilepticus resulting from the use of hyoscyne hydrobromide or from morphine, in either large or small doses.

Some few cases of status recover without treatment; others go on to a fatal termination, despite every care and attention.

Lumbar puncture has been used in the treatment of status epilepticus with varying degrees of success. In this condition there is an increase of intracranial tension, which, theoretically, should be relieved by such a procedure. In my opinion, however, the result of such treatment has not materially lowered the death-rate in status epilepticus.

Mentally disturbed cases should be treated by hydrotherapy, nourishing liquid diet, and good, tactful nursing. Use sedatives as little as possible. Baths or hot packs, properly used, the latter with an ice-cap to the head, will quiet the ordinary excited cases. Watch out for exhaustion and pneumonia. This treatment of the individual is what is required and must be ever kept in mind.

It is difficult and well-nigh impossible to care for the epileptic properly unless suitable provision can be had over every little detail of his daily life, regulating the individual patient as indicated, with the idea of making him as nearly normal as possible. Glasses should be fitted where required; adenoids and enlarged tonsils removed; pelvic organs operated upon where indicated; hemorrhoids removed; dental caries treated, or, in a word, place the individual in the best possible physical condition. Unless the little details are attended to constantly, one cannot hope to obtain beneficial results in treating this disease.

Solanum carolinensis, borax, zinc, and nearly every drug in and out of the pharmacopœia have been used and recommended for the relief of epilepsy since time immemorial, but any one who has had experience must admit that the question of hygiene, diet, occupation, and the correction of abnormal conditions, when possible, are the proper foundations on which to base the scientific treatment of epilepsy, these to continue not for a brief period of a few weeks or months, but during the lifetime of the individual in question.

The majority of epileptics constantly importune the physician for medicine, feeling that a remedy may be finally obtained if the trial over a varied list of drugs be but sufficiently extensive.

In many cases of epilepsy people seem to suppose that the physician, especially if he be at all skilled in treating this complaint, can prepare and send a medicine which will cure, or, at least, do as much good as though he saw and examined the patient and then prescribed for him.

The use of quack remedies must be combated. Epileptics, being chronic invalids, are ever grasping at every new straw that comes within their field, consequently succumb readily to the wiles of the sure-cure advertiser, who promises all sorts of miraculous cures within short per-

iods by the use of remedies alleged not to be known to the medical profession at large. Most of these nostrums contain large quantities of bromide, usually the potassium salt.

The physician should never promise any epileptic a complete cure by any known method of treatment. Absolutely permanent cures, in which there is no possibility of recurrence, are unknown. It is a well-known fact that, without any particular treatment, epilepsy may undergo spontaneous cessation of seizures even after the convulsions have been present for many years.

It has come to be recognized by many careful observers that there is no such condition as the one formerly known under the term "hystero-epilepsy."

Hysterical symptoms are, as is well known, seen at times in individuals having true epilepsy, as are also epileptoid symptoms seen in others, but this does not warrant our using this expression to designate the group of symptoms under consideration.

Writers describe a type of recurring attacks, which is neither hysterical nor epileptic, occurring in persons of a psychasthenic temperament. Some of these symptoms are at times exceedingly difficult of exact identification as to leading toward a positive diagnosis of either epilepsy or hysteria.

Gowers, Turner, and others class these symptoms as (1) vaso-epileptoid and (2) as psycho-epileptoid. The vaso-epileptoid attacks, as described by Gowers, consist of definitely vasomotor symptoms, such as coldness of the limbs, pallor of the face, shivering almost amounting to rigor, tingling and numbness of the extremities, and sometimes a slight tetanoid spasm. A more complete development of the seizures, from his descriptions, shows a close relationship to epilepsy.

The symptoms of the vagal attack, as given by Gowers, are: (1) Sensations referred to the stomach, heart, and respiratory systems; (2) the ascent of the sensation from the stomach to the chest, throat, and head; (3) it is accompanied by a feeling of respiratory distress and cardiac oppression, fear, and a sense of impending death; (4) there is no true loss of consciousness, but the mental operations are slow and sometimes characterized by a feeling of unreality; (5) the attack ends with a great acceleration of the heart's action; and (6) the whole attack lasts for about fifteen or twenty minutes. These may be brief or not in duration, and recur at varying intervals. Dana observed an associated element of thyroidism in similar seizures.

Turner describes the psycho-epileptoid attacks as seizures in which symptoms appear as of a psychical character, usually a sense of apprehension, dread, or fear. They are commonly associated with sensations of nervousness, numbness, coldness, nausea, cephalic sensations, and are frequently accompanied by sensations of a vague, indescribable character. Sometimes the feeling of fear is intense, and may be replaced by a sense of impending death. In the true attacks of this kind consciousness is never abolished, but the mental state may assume a dreamy attitude, with a feeling of unreality. The attacks occur in persons who pre-

sent other features of a psychasthenic character, such as dreads, fears, and apprehensions. There is usually also a well-marked neuropathic heredity. Although in many cases the attacks are of the kind just described, there are other cases in which these attacks merge into epileptic seizures. In these conditions no tendency to mental deterioration has been noted. Many of these border-line conditions have been ascribed to functional disturbance of the lower centres in the medulla oblongata.

Night terrors in neurotic children are frequently seen, and indicate ordinarily an unstable nervous system. If they continue in adult life, they are applied to nocturnal seizures. I have seen them as equivalents in true epilepsy. Somnambulism and sleep-talking may be associated with these night terrors.

Turner calls attention, however, to the fact that attacks of a temporary occurrence, in which a patient wakes suddenly in a state of fear, apprehension, or panic, indicate a state of nervous strain induced by overwork or anxiety, and not infrequently excited by some gastrointestinal disturbances. He states that sleep symptoms, such as are found from time to time in persons of a highly nervous temperament, should be regarded as symptoms of importance, and classed as phenomena upon the borderland of epilepsy.

These borderland cases, so clearly described by Gowers, require treatment along lines indicated by the symptoms of the individual case. Undue mental stress and physical effort must be eliminated from their lives. Light outdoor occupations, which will give a healthy, but not excessive, fatigue, are of utmost importance in those who are younger. In less robust patients, fresh air, massage, rest, and a tranquil life are essential as a basis for relief of symptoms.

Tonic treatment is often indicated to place the patient in a condition where he can better withstand deleterious influences. All digestive disturbances must be corrected. Cardiac cases require digitalis, strophanthus, carefully regulated exercise, etc., as may be indicated. Gowers recommends nitroglycerine, up to a minim of the 1 per cent. alcoholic solution, given two or three times daily, to those patients exhibiting vasomotor spasm as part of the attack. For immediate influence on the attacks he advises nitrite of amyl. Small doses of bromide may be used for their general tranquilizing influence. In his opinion, "general acquaintance with these conditions must become far greater than it is before effective therapeutic experience can slowly grow and gather weight."

For the relief of headache in this condition, as in true epilepsy, anodynes are oftentimes necessary, but should be used with care. Phenacetine and codeine have, in my experience, been the most satisfactory. Uninterrupted sleep following a seizure is without doubt the most rational means of affording relief from this symptom.

For the sleep symptoms a dose of bromide regulated to the individual and administered early in the evening is of value.

Many writers, cited by Fox and Jones, agree that the psychoneuroses can very closely mimic the different kinds of epileptiform attacks, and

that the diagnosis epilepsy is only permissible when all other conditions capable of inducing epileptiform attacks, particularly hysteria and psychasthenia, either positively can be excluded or recognized as associated conditions. They maintain that epilepsy appears to be incapable of causing any symptom which cannot be duplicated by psycholepsy.

If, by the use of psycho-analytic methods the memories of the different phases of the attack can be reproduced the condition is not epilepsy. Fox states that psycholeptic and epileptic seizures may alternate.

These observers have found that the individual symptoms in psychasthenia immediately disappeared without returning if a thorough awakening could be obtained of the memories of the causative process with its accompanying effect, and if the patient could discuss the process, giving free play to the effect.

Boris Sidis, in writing of functional epileptiform seizures originating in dissociated psychic states, describes how, by analysis and by hypnosis, he attempts to restore the psychic sphere to a normal state of association.

Fox recommends for these psychasthenic cases exercise in the open air, social intercourse, interesting occupations, etc., to withdraw the patient's attention from himself. The patient's self-confidence must be aroused and stimulated.

A careful dietetic and hygienic regimen must be planned out as carefully for patients of this type as for the genuine epileptic. Hydrotherapeutic measures, prescribed with discrimination, are of much value in the building up of the individual toward his establishing himself on a firmer foundation for meeting the stresses of every-day existence. Too much sympathy must not be given or it will prolong the abnormal state and interfere materially with improvement.

The treatment of the psychasthenic fit itself must be largely one of observation to prevent any injury.

The treatment of these particular cases by methods of psycho-analysis and suggestion cannot be carried out successfully, except by those few who have had much experience in such methods. It must be borne in mind that a certain amount of suggestion is essential in the treatment not only of epilepsy and of allied disorders, but is used by every medical man in his general practice.

TETANUS

According to Elting, the scientific study of tetanus dates from 1884, when Nicolaier described the tetanus bacillus, and demonstrated the presence of this bacillus in the pus from the wound of a man with tetanus, and Nocard, in 1887, made the same observation in the case of a horse with tetanus.

The work of these investigators furnished an adequate etiological basis for the subsequent study of the disease and the perfection of a rational method of treatment.

From the focus in which the tetanus bacilli multiply the toxin produced readily gains access to the circulation, from which it appears to be quickly absorbed by the central nervous system, and especially the

spinal cord and medulla, in which structures its presence has been demonstrated, as well as in the cerebrospinal fluid.

The treatment of tetanus can be divided as follows: The destruction of the tetanus bacilli at the site of entry; the effort to neutralize the tetanus toxin; the control, if possible, of the tetanic convulsions; and the maintenance of the strength of the patient.

The destruction of the bacteria at the site of injury is accomplished by prompt and thorough cleansing of the wound or wounds, by free incision, with removal of every particle of foreign matter and of tissue injured beyond repair, by cauterization in a vigorous manner with a 25 per cent. solution of phenol in glycerine or alcohol. After this thorough cleansing the wound should be allowed to heal by granulation, the dressings being changed at least daily.

Tetanus antitoxin was discovered by Behring and Kitasato, when these observers demonstrated that the blood-serum of an animal rendered artificially immune from tetanus possesses the power to neutralize the tetanus toxin. The tetanus antitoxin protects only against the tetanus toxin, but has no bactericidal action upon the tetanus bacilli.

It was at first hoped that the antitetanic serum would control tetanus in the same manner that antidiphtheritic serum does diphtheria. The nature of the disease, as well as the conditions attendant upon its development, have, however, made the results of the antitoxin treatment of tetanus far less favorable than anticipated.

In many cases the fatal dose of tetanus toxin has already been produced and absorbed before a diagnosis of the disease can be made. It has been shown that antitoxin has practically but little effect upon the toxin already attached to the motor cells of the spinal cord and medulla; thus its function becomes mainly the neutralization of the toxin not yet thus attached, with a very slightly curative effect upon the deranged motor nervous system. It has also been demonstrated that in many instances there is little or no tetanus toxin in the blood at the time of the development of symptoms, and very often at this time the tetanus bacilli have all disappeared from the site of entry. All the toxin has been absorbed by the central nervous system, and the benefit to be obtained from the antitoxin administered will be decidedly limited. All writers emphasize these facts, so that a more intelligent use may be had of the antitoxin to bring about a favorable action in many cases of tetanus.

To delayed, insufficient, and improper use of antitetanic serum is ascribed death from tetanus in our day. In all cases where there is even a remote possibility of infection by this bacillus a preventive dose of the serum should be injected when the wound is first attended to.

The New York State Department of Health lays emphasis on the statement that a moral responsibility rests on every physician to realize the vast importance of using prophylactic doses of 1500 units of antitetanic serum in every suspicious case. Unless he does so, he is certainly culpable. (See Serum Therapy in Volume I.)

The antitoxin may be administered in the following ways: (1) Subcutaneously; (2) intravenously; (3) intracerebral injection; (4) subdural

injection. No one of these routes precludes the employment of any or all of the others mentioned.

(1) The subcutaneous injection of the antitoxin involves the same strict technique as does the ordinary administration of diphtheria antitoxin. Large doses of from 10,000 to 20,000 units every six to eight hours are recommended. The not uncommon sequels, such as urticaria, joint pains, etc., of sera injections may occur, but usually disappear in a short time. The subcutaneous injections should be made directly into the muscles on the anterior surface of the body.

(2) The intravenous route for injection may be used with the same dosage as for the subcutaneous. The serum should be a degree above the rectal temperature and be injected slowly.

(3) Trephining and then injecting the antitetanic serum directly into the frontal lobes of the cerebrum or into the lateral ventricles has been practised. The technique of such procedure must be most strict. Not over three centimeters should be injected.

Elting concludes: "The results of the intracerebral method of injection show that they are not more favorable than those obtained by other methods, and it has furthermore been shown that this method is not altogether devoid of danger. Cases are reported in which serious accidents, and even death, have followed the employment of this method. Autopsies upon these cases have shown foci of hemorrhage or meningitis, and in at least one case cerebral abscess. The difficulties attendant upon this method of administration of the antitoxin place it out of the reach of the general practitioner."

The subdural injection by lumbar puncture requires the use of a long needle to gain entrance to the spinal canal. The site usually selected is between the third and fourth lumbar vertebræ, at a point about one-half inch to either side of the median line. When the spinal canal has been reached, the cerebrospinal fluid may be permitted to escape in amount to correspond to the quantity of serum to be injected. The serum should be warmed to body heat and injected slowly.

If necessary, during the acute stage, the intraspinal injections may be used every eight hours. When this stage has passed, the subcutaneous injections will suffice. The serum treatment should be continued until muscular rigidity is no longer evident.

In the use of antitetanic serum, as in antidiphtheritic serum, large doses early, and as frequently as indicated, are of the utmost importance. One cannot expect beneficial results from any medication unless the proper dosage is employed.

If some time has elapsed from the receipt of infection before symptoms begin to manifest themselves, the dosage of the serum must be several times that required when it is given as a prophylactic measure.

A dusting-powder of antitoxin to employ on denuded surfaces for absorption is on the market and is useful.

For the control of the convulsions a great number of sedatives have been proposed, but of the number morphine, chloral, and the bromides are alone reliable. They should be administered in sufficiently large

doses to obtain the results desired. The morphine should be given hypodermatically, and the chloral and bromides, especially chloral, by rectum. Before the administration of any drug by the rectal route the bowel should be thoroughly emptied by a cleansing enema. Postural methods will assist materially in the retention of the chloral enema.

Nutrient enemata for the support of the patient's strength are necessary, unless it is possible for him to take liquid food by the ordinary route. Normal salt solution subcutaneously is of value when the patient cannot take liquids freely by mouth or rectum. The kidneys and skin are thus encouraged to functionate, and the elimination of ununited toxin, as well as the fatigue substances produced in the muscles, is accelerated.

Meltzer, after experimental research, advised the use of intraspinal injections of magnesium sulphate in a 25 per cent. solution. He concluded that magnesium sulphate, in doses of 1 c.c. per twenty pounds of body weight, was capable of abolishing completely all clonic and tonic contractions, thus tiding the person over until the newly formed antitoxin can overtake the balance of free toxin, and the metabolic processes of the body have mastered the toxins fixed by the nerve-cells. Several observers report beneficial results following the use of these injections.

At the present day the thorough care of the wound, the proper use of antitetanic serum, and the support of the patient are the three essentials in the treatment of this disease.

CHOREA

Acute chorea, also known as Sydenham's chorea, chorea minor, and St. Vitus' dance, is, to quote D. J. McCarthy, "A disease occurring chiefly in children, due to the effect of an infectious agent, or its toxin, on the central nervous system, characterized by irregular, involuntary muscular contractions, resulting in movements of a purposeless nature, and associated with psychic manifestations."

A large number of patients with chorea present a nervous, excitable temperament, or, as McCarthy says, a certain type of child might be referred to as of a choreic temperament. These children, usually girls, are unduly active, showing much motor unrest. When such children have Sydenham's chorea, it is extremely difficult to see where the normal movements cease and where the manifestations of the disease begin. This is particularly true during convalescence. On such a soil it takes but little intoxication of the nervous system, from a relatively mild infection, rheumatic or otherwise, to produce a well-developed case of chorea. In nervous children a decided emotion, such as fright or excessive mental strain, may be the determining factor in the precipitation of an attack.

It must be borne in mind that in chorea, like epilepsy, the disturbance of the function of the cerebral motor apparatus may occur as the result of various causes.

McCarthy refers to the slight or negative articular manifestations of rheumatic fever in childhood, but does not agree with some of the ob-

servers that every case of endocarditis, pericarditis, and myocarditis in childhood, in the absence of joint manifestations, is to be considered rheumatic. He says we must consider, on the one hand, that an infection in childhood is likely to be associated with vague pains, and that, on the other hand, gonorrhœa, beri-beri, syphilis, influenza, tuberculosis, erysipelas, pneumonia, and meningitis are associated with single and multiple arthritic manifestations which are described as "rheumatism," etc.

In this connection it should be noted that any condition, whether of an infectious nature or not, if it lowers the vitality of the organism and thereby lessens the nerve tone, renders the child more susceptible not only to chorea, but to other functional nervous disturbances. In this way any of the infectious diseases—*anemia*, etc.—may act. The toxic influence of any of these infectious diseases, however, should be borne in mind.

All practitioners are quite well agreed upon the necessity for observing strict rules relative to avoidance of fatigue, to preservation of strength and nutrition, and to a rigid hygiene, but there is some difference of opinion as pertaining to the question of the medicinal treatment of acute chorea. Some differ also as to the degree of rest required during the treatment. There is a consensus of opinion that chorea at all times, even the milder forms, is sufficiently serious to demand the careful attention and supervision of the physician. All patients do better, the course of the disease is shortened, and the danger of complications lessened by excluding anything that tends to produce mental excitement. A nurse trained to handle nervous children is a very helpful adjunct to the treatment.

The diet should be simple and nutritious, with tea and coffee excluded. In the severe cases close supervision is necessary, and care should always be used in permitting visitors. School work must be entirely done away with during the period of illness.

Koplik, Collins, and others call attention to the fact that true acute chorea partakes in its course and symptoms of the character of an acute infectious disease of self-limited duration, and should be treated accordingly. Koplik feels that it is an infection pure and simple, and that in some cases the cardiac structures are apt to be involved. In view of this he considers it surprising that the therapy has not been in keeping with these facts.

Considering chorea as a self-limited disease, it would seem logical to treat the condition by careful hygienic methods, using hydrotherapy for its tonic effects. The quiet companionship of other children cannot harm the less severe cases.

In the most severe cases, those designated as paralytic chorea, more complete isolation is recommended, yet with plenty of air and sunshine. Hydrotherapy and tonic doses of strychnine are of value. Patient and careful nursing is, therefore, the all-important thing in the treatment of acute chorea, as in all other similar conditions. Much harm may result from unnecessary medication.

Koplik feels that children need air and sunshine, not isolation in a dark room, for an indefinite period. The worry and fretting often entailed from such isolation tends to aggravate the child's condition.

He cautions against undue excitement or exposure which might cause the disease to pass into a more serious form. A modified rest-cure is advisable in mild cases, with perhaps slight sedative medication. Open air and gentle play are more in accord with child nature.

Collins found that one of the best measures in contributing to the maintenance of nutrition, and, at the same time, the quietude and comfort of the patient, is the shock and counterirritation of cold water, poured from a height or thrown forcibly against the back of the neck and spine once or twice a day. When the motor unrest is very great, he advises the use of the cold wet pack, especially before retiring. It is not only soothing to the patient, but contributes to refreshing sleep. For this purpose it is more serviceable than hypnotics, and has the advantage that it produces no after-effects except gratifying ones. After the first one or two applications children do not rebel against it; in fact, they enjoy it.

In the medicinal treatment arsenic, in the form of Fowler's solution, is of value, but it is questionable, however, whether its value is more than that of an alterative tonic. The drug should not be given in large doses, as its full value may be obtained by the administration of small doses; two or three drops, gradually increased until ten drops, three times a day are taken. It ought never to be administered except when the patient is under the personal observation of a physician. Indiscriminate and persistent use of the drug may result in arsenical neuritis and serious disturbance of the metabolism of the child. Extensive herpes zoster has been attributed to its use. Donovan's solution may be administered in doses of two to five drops, in older children, three times daily, but here again the patient should be carefully observed.

Allan, in contradistinction to most writers, believes in rapidly saturating with arsenic. He maintains that if arsenic is going to do good in chorea, beneficial results will manifest themselves during the first two weeks.

Koplik lays emphasis on the watching of the kidneys during the administration of arsenic. His experience has taught him that albumin and casts appear in many cases who are under moderate dosages of arsenic. In these Fowler's solution, even though freshly prepared, appears to act as an irritant to the kidney structure. He advocates daily examination of the urine, except where minute tonic doses of arsenic are given. As soon as albumin appears, he recommends a cessation of the arsenic.

Sedative drugs, such as chloral, bromides, hyoscine, chloretone, extract of *cannabis indica*, antipyrine, etc., have been used to control the more severe cases, but it would seem that proper hydrotherapeutic measures—*e. g.*, packs—would be more rational.

Massage and overfeeding are often required in the cases which are of poor physique. The individual case must be studied carefully, and in some, a change in environment is demanded.

Kerley relates that antirheumatic treatment and diet have made his results strikingly better. He advises sodium salicylate and sodium bicarbonate or aspirin. He gives them intermittently to avoid interference with digestion. He gives Fowler's solution in conjunction with the salicylate, rarely using more than ten drops three times daily to procure satisfactory results. Kerley forbids candy, and reduces meat to once every second day.

McCarthy feels that antirheumatic remedies are of value in the control of rheumatic symptoms, but have relatively little influence on the course of the chorea.

The child who has once had chorea should have a quiet, well-regulated life, so as to avoid a recurrence. Forcing at school must not be permitted under any circumstances.

When the choreic symptoms are so severe and persistent as to interfere with sleep and feeding, the use of the hot pack is a most valuable measure.

DRUG HABITS

By F. X. DERCUM, M.D.

General Considerations.—In a study of the drug habits, it is of the first importance to consider the question of etiology. A moment's reflection will convince one that this etiology is varied. Drug habits occur in three classes of individuals: First, in those in whom there is a neuropathy, hereditary or acquired; secondly, in those in whom a habit has followed the prolonged use of a narcotic or sedative, originally prescribed for some illness; thirdly, in those in whom a habit has been acquired incidental to social life. The first class is separable, as indicated, into those in whom the habit is associated with an hereditary or congenital neuropathy and those in whom the habit is associated with an acquired neuropathy. It has long been known, and is, indeed, a matter of lay experience, that one of these habits, namely, alcoholism, may be hereditary and sometimes passes uninterruptedly from generation to generation. An inquiry into the family histories very frequently reveals the presence of various functional nervous disorders; often there is a history of nervous breakdowns or of general inefficiency and incompetence in the struggle of life. Not infrequently, more clearly defined neuropathic features are discoverable. Thus, it sometimes happens that in the same family in which hereditary inebriety occurs there are also instances of the insane neuroses, of marked eccentricities of character or of excessive precocity or genius, running hand in hand, perhaps, with imbecility and idiocy. In other instances well-defined mental diseases are presented by the family history. Now and then the personal history of the patient suggests that he is really suffering from a mild or incompletely developed form of manic-depressive insanity, long periods of emotional depression, not amounting to actual melancholia, alternating with mildly expansive or relatively normal periods. The frequent occurrence of tuberculosis also in the family history of alcoholics can only be regarded as in keeping with the general weakness of stock and resistance so frequently found among alcoholics. In cases in which the family history suggests merely an hereditary tendency to neurasthenia, the outlook is, of course, somewhat more favorable than in those in which the neuropathy is more pronounced, provided, of course, that measures can be instituted to favorably influence the manner of living, occupation, and other factors influencing the nervous strain upon the individual. When the drug habit appears to be the outcome of an acquired neurasthenia or neuropathy, the outlook is, of course, decidedly more hopeful.

In all cases the treatment is to be directed not merely to the withdrawal of the drugs, but primarily to the underlying nervous exhaustion. It is important in this connection to recognize the fact that it is not usual for a drug habit to be acquired as the result of the use of a drug or stimulant prescribed medicinally, especially if the patient be of normal nervous organization. Indeed, we are usually justified, if such a habit be formed under these circumstances, to inquire into the existence of an underlying neurosis. For example, if after the treatment of a case of typhoid fever it is found that the patient has acquired the alcoholic habit, we should inquire as to a family history of inebriety or of various functional nervous troubles suggesting neurasthenia or neuropathic conditions. To strictly normal individuals the use of stimulants—especially of alcohol—beyond the limits prescribed by ordinary social usage is unpleasant and distasteful; and even when, as the result of special social occasions, alcohol is taken in excess by such persons, a disgust for the drug ensues which leads to a period of relative abstinence. In neurasthenic, and especially in neuropathic, individuals the after-depression from the excessive use of stimulants is so great, and is accompanied by so much psychic pain and physical suffering, that a craving for the drug may ensue.

Among inebriates, especially alcoholics, we can find two classes of individuals: First, those in whom the drug or stimulant is used habitually day after day—of this class, the so-called moderate drinker is typical; secondly, those in whom the stimulant is taken at regularly or irregularly recurring periods, the intervals between the attacks being characterized by more or less complete abstinence. In such persons an attack may be provoked by unusual nervous overstrain or may recur at certain physiological periods, such as the menstrual epoch. Again, it may be provoked by the use of a stimulant socially or in accordance with medical advice. To this class especially belongs the periodic inebriate, the one who goes “on sprees.”

These remarks, while they may apply more especially to alcohol, apply also to other drugs, as, for instance, the use of opiates by women at the menstrual period. In general, the facts in regard to alcoholism apply in a large measure to the other drug habits, and it would seem proper, therefore, to give to alcoholism our first attention.

ALCOHOLISM.

Alcoholism occurs in two forms—(1) acute alcoholism; (2) chronic alcoholism. Chronic alcoholism occurs, as we have just seen, in the continued and the periodic forms.

We will consider first acute alcoholism. Acute alcoholism may manifest itself merely as an attack of acute alcoholic intoxication, in which there may be present transient exaltation, to be followed by confusion or it may be stupor. However, if alcoholic excess be continuous or be repeated at short intervals, a condition may finally supervene

characterized by acute delirium and signs of exhaustion—the so-called delirium tremens.

With the attack of acute alcoholic intoxication we have, in the consideration of drug habits, really little to do. A few words, however, as to the management of such an attack may not be out of place. If there is reason to believe that there is still unabsorbed alcohol in the stomach, the stomach should be washed out or free vomiting should be induced, either by the administration of copious draughts of warm water, or of other remedies by means of which the stomach may be readily evacuated. Rosenwasser believes that it is best to give apomorphine hypodermically; the apomorphine not only empties the stomach, but produces sleep, and in small doses acts as a heart stimulant. In cases difficult of control this method obviously offers distinct advantages. Subsequently, or even without the previous administration of an emetic, it may be of advantage to administer a brisk cathartic; and to this end a saline purge, such as a full dose of Epsom salt, is frequently efficacious. At times it is better to administer a pill of blue mass or calomel before giving the salt. If a Turkish bath be available, this measure may also be instituted; the bath, of course, stimulates elimination by the skin, and it seems also to stimulate elimination of the poison by the lungs. It is not an uncommon experience to have an intoxicated man repair to a Turkish bath and then emerge, after an hour or more, almost if not completely sober. If a Turkish bath be not available, a full hot bath in an ordinary tub is often efficacious.

Measures should also be instituted for averting the post-alcoholic headache and depression, which are often of great severity. It is well, therefore, after having given a Turkish or hot bath, before allowing the patient to sleep, to administer a full dose of the bromides, say a dram. This remedy is so efficacious that in many cases in which the bath is not available, the bromide itself permits the patient to awaken the following morning with little or no cephalic distress. The effect of the bromides is much increased by combination with a dose of antipyrin, say 10 grains. Caffeine also is useful. Various combinations of the bromides with caffeine are sold in the form of effervescing draughts by druggists.

Treatment of Delirium Tremens.—If the alcoholic debauch has been sufficiently prolonged and sufficiently deep or repeated, the condition known as delirium tremens may intervene. Measures should at once be instituted such as are indicated in ordinary delirium when associated with profound exhaustion. The patient should always be confined to bed. Not infrequently a certain amount of physical restraint becomes necessary; and this is best accomplished by fastening the patient in bed by means of the sheet, but in so doing we should be careful to do nothing to impede respiration. A sheet loosely rolled may be carried from the back of the neck forward, over both the shoulders, under the arms, and fastened under the bed. To restrain the legs a sheet may be separately looped about each foot and likewise fastened under the bed. Sometimes it is wise to apply leather gauntlets to the wrists and ankles. Very often the patient is physically so ill that restraint of any kind is unnecessary.

As in other asthenic states, a treatment should be adopted the aim of which is to support the strength of the patient. Milk, eggs, beef tea, beef peptonoids, and other beef preparations should be employed. These should be given in relatively large quantities and at frequent intervals, say every two hours.

At the same time supporting drugs should be given as indicated. Among these we should especially mention strychnine, digitalis, and atropine. The strychnine had best be given hypodermically, in doses of $\frac{1}{40}$ to $\frac{1}{20}$ of a grain, at intervals of about every four hours. The digitalis may be given either by mouth or preferably hypodermically. For this purpose either the fluidextract or the preparation known as digitalone may be employed. The latter has in my hands proved most serviceable. Fifteen or twenty drops, or even thirty, may be given at four-hour intervals until the effect of the drug on the pulse becomes noticeable, when the dose should be diminished or for a time suspended. Should there be excessive sweating, especially cold sweating such as attends general failure and collapse, atropine should be added. This should be given in doses of $\frac{1}{150}$ of a grain or more and repeated at intervals of four hours, according to the effect produced. Bechet recommends the use of apomorphine and strychnine. He claims that the apomorphine acts as a sedative and hypnotic, while the strychnine counteracts the depressing effect of the apomorphine on the heart and respiration. Bolton besides using apomorphine, gives at the same time tincture of cinchona and tincture of capsicum.

Whether alcohol should be administered in a given case is a matter requiring careful consideration. As a rule, it is necessary to give a certain amount of alcohol; sometimes it must be given very freely. Pilcz, of Steinhof, Vienna, who treats his cases by the administration of calomel and the institution of a milk diet, gives alcohol if the heart becomes weak. He regards the delirium as an abstinence symptom. It will be found, however, that in many cases in which forced feeding is practised, and in which full doses of strychnine and digitalis are being administered, the alcohol can be limited to relatively small quantities. However, when in spite of other measures the pulse fails and becomes very frequent and weak, and the skin becomes cold and clammy, alcohol must be given in full doses. There can be no doubt, also, that at times the delirium is really the direct result of the sudden stopping of the alcohol, and in such cases it is wise to administer the alcohol again for a time. Frequently a solution of ammonium acetate, a half ounce every hour or two, proves very serviceable in permitting a more rapid and earlier withdrawal of the alcohol, keeping up elimination and stimulating the heart. At times it is well to combine this remedy with ammonium carbonate.

In the majority of cases the physician is also compelled to resort to various sedatives in order to induce sleep. Not infrequently this is accomplished with considerable difficulty. One of the most valuable drugs that we have to induce sleep promptly and at the same time without any depression is paraldehyde. This may be given in from one

to two teaspoonful doses in an ounce or two of whisky. Notwithstanding the unpleasant taste of the paraldehyde, the patient usually takes it very readily. Unfortunately, the duration of the sleep produced by the paraldehyde is relatively short. Many alcoholics will sleep only four hours on a full dose and sometimes less. The remedy is, however, invaluable, because sleep ensues within ten or fifteen minutes after the dose has been taken. It may, therefore, be employed with great advantage to start the sleep. At the same time that paraldehyde is given, ten or fifteen grains of sulphonal may be administered. The sulphonal is absorbed slowly, acts slowly, and the sleep produced by the paraldehyde, reinforced in this way, is often prolonged for a number of hours.

Other hypnotics may of course be employed. Of these, we may mention trional, sulphonal, and veronal. Trional is not, as a rule, as efficacious as a combination of trional with sulphonal. say twenty grains of trional with ten grains of sulphonal. Instead of these drugs, veronal may be administered in ten grain doses.

Chloral may, of course, also be employed to induce sleep, but its occasional untoward cardiac effect should not be lost sight of. Its use is opposed by some writers, *e. g.*, Ganser; notwithstanding it is still employed by others, *e. g.*, Aufrecht. If chloral be given at all, it had best be given in combination with a bromide and with a small dose of morphine.

Occasionally hyoscine hydrobromate, recommended by Hare, or preferably scopolamine, may be employed. These remedies have the advantage of hypodermic administration. Marked quiet and sedation is sometimes produced by the administration of scopolamine with a small dose of morphine, say, scopolamine, grain $\frac{1}{100}$, and morphine, grain $\frac{1}{8}$. It is far better to tide over the restlessness and sleeplessness by moderate doses of hypnotics than to push these excessively, especially as in the majority of cases sleep is usually induced readily on the second and almost always on the third day. We should remember, in regard to morphine, that alcoholics are sometimes dangerously tolerant to the drug; one dose failing to induce quiet, a second dose may be resorted to after too short an interval. The fact also of the not infrequent disease of the kidneys met with in alcoholics should make us additionally careful. We should at first be satisfied with a moderate amount of sleep, for as time passes and the symptoms subside, sleep comes on spontaneously, and sleep having been once established, it is a small matter to keep up the feeding and rest until the attack has passed away. As a rule, in cases that are properly fed, and in which supporting measures are used judiciously, sleep supervenes without the excessive use of narcotics. If the case be complicated by pneumonia or other visceral disease, this, of course, demands special attention. Supporting measures are then doubly indicated. Under these circumstances it is, as a rule, necessary to use alcohol freely and opiates in small doses. If there be suppression of urine or serious renal involvement, hypodermoclysis or possibly intravenous saline infusion with or without venesection are among the measures to be applied.

CHRONIC ALCOHOLISM.

In chronic alcoholism the fact of an underlying neuropathy is usually so evident, and assumes such an importance, that it should be taken into account whatever the plan of treatment. Usually the durability of the result depends upon the degree of attention which has been given to this underlying neuropathy. The outlook is, of course, least favorable of all in cases in which there is a frank history of confirmed hereditary inebriety. In other words, it is most favorable in cases in which the habit has been formed merely as the result of social drinking; less favorable in those in which it has resulted from an acquired neurasthenia, and least favorable in those in which it manifests itself spontaneously without exciting cause in the form of solitary drinking. It is always necessary, as a matter of course, to study in detail the visceral symptoms which the patient presents. There is almost invariably present a chronic gastric catarrh. The liver also should be examined, bearing in mind the relation of alcoholism to cirrhosis. The heart and bloodvessels and especially the urine should likewise be carefully studied. There should, of course, be a complete physical examination, including the lungs, for one should not forget the frequent co-existence of phthisis in alcoholics. The practical points to bear in mind are, first, that an alcoholic man is a man who is ill, ill as a result of chronic poisoning, a poisoning which induces changes in the viscera, slight or pronounced, as the case may be. It is when we come to estimate the future and the question of prolongation of treatment that the matter of an underlying neuropathy or other hereditary factors comes into play.

Treatment.—Having carefully studied our patient, the first problem that presents itself is the withdrawal of the poison. While opinions differ, it has been my experience that it is always best to attempt rapid or immediate withdrawal. If no recent excesses have occurred, this can, as a rule, be accomplished without much difficulty; if, however, the patient is just passing through an alcoholic attack, or has recently committed more than the usual excesses, the withdrawal had best be more gradual. The moral effect of a too gradual or too prolonged withdrawal is bad; and, as already stated, a withdrawal as rapid as is consistent with safety should be instituted. We should be guided largely by the nervous symptoms and by the action of the heart. Collapse, mental confusion, delirium, and excessive prostration, of course, demand a gradual withdrawal. Whenever possible, the alcohol should be given with food.

Having decided the question as to the rate of withdrawal, it becomes necessary to lay out a plan of treatment. Drugs, so much dwelt upon by others, are assigned a secondary value by myself. In my judgment, natural therapeutic measures are far more important and lead to far more satisfactory and durable results. As we shall see, they are readily applicable to the underlying nervous disorders so commonly present in these cases. Drugs may, however, be used at the same time

with advantage, but their employment depends upon each individual case. No routine method of their application, no one drug, no one formula, can be considered as applicable to every case. The use of a given drug depends entirely upon the symptoms present and varies with each case.

What special method, then, shall we adopt of treating the continuous form of alcoholism? It is, of course, evident that if neurasthenic features be present and are treated, if the general tone and vigor be improved, the desire for stimulants will be lessened. In some cases it is possible, merely by strict attention to hygiene, to matters of diet, to hours of sleep, and regulation of the various functions, to bring about a favorable result; but in the majority of cases such simple means will not suffice, and it is necessary to institute measures involving some degree of restraint. Unfortunately, as most governments are at present constituted, forcible measures of restraint, except in unusual cases, cannot be carried out. If possible, the consent of the patient to comply with certain conditions of treatment should be gained. In a few instances the exaction of a promise or the signing of the pledge will suffice. In others, again, and in by far the larger number of cases, more decided measures are necessary. It is now possible in certain States, for example, in Pennsylvania, to commit a patient as an inebriate to an asylum for the insane. Two or more physicians and lay persons, relatives or friends, testify before a judge or magistrate in the presence of the patient whom they intend to commit, as to his inebriety, and state the reasons why they wish to commit him. Under these circumstances the authorities may commit him to an asylum for a year. It would, of course, be a far better procedure if the patient could be committed to a special hospital for inebriates, but in the absence of such an institution the authorities for the insane accept and detain the patient just as though he were one who is committed to their care as insane. So radical a procedure as this is, of course, if possible, to be avoided.

A far better way—an ideal plan but unfortunately a somewhat expensive one—consists in withdrawing the patient from his ordinary surroundings and instituting a system of complete isolation, and, at the same time, placing him in the care of a specially trained nurse—of the same sex, of course, as the patient. Such a plan as this is, in suitable cases, almost invariably followed by the most gratifying results, results which also are far reaching and frequently permanent; for the isolation of the patient gives the physician the very best opportunities for the study of the morbid conditions underlying the disease and for their proper treatment.

My own plan is to institute a form of so-called "rest treatment." The isolation in a room with a special nurse constitutes the most effective means of restraint that can be devised, while the moral effect is of the very best. It is my plan to place the patient in bed and to keep him in bed, not for days, but for many weeks, and to institute at the same time massage, baths, Swedish movements, electricity, and such other expedients as suggest themselves from time to time or are indicated by

the case. It cannot be too strongly insisted upon that the victim of alcoholism is the victim of disease, and that very frequently the relief obtained from various distressing symptoms by merely remaining in bed is so great as to be followed by a rapid diminution in the appetite for the stimulant.

The patient having been placed in bed, it is frequently found necessary to administer small doses of calomel, and to follow these after a time by a saline cathartic. The digestive tract having thus been prepared, systematic feeding should be commenced. As a rule, it is best to begin with a liquid diet. This should at first be limited to beef tea, broths, soups, and meat preparations generally. As soon as possible, however, a milk diet should be instituted. A great many alcoholics aver that they cannot take milk; that it increases the coating of the tongue, and that its ingestion is followed by nausea and loss of appetite; but, as a rule, we will be able to administer milk if the proper precautions are observed. The simple expedient of adding a little alcohol answers every purpose, for it is then readily tolerated by the stomach and acceptable to the patient. At other times, instead of adding alcohol to the milk, our purpose is answered by diluting the milk with some carbonated water, such as soda water or Apollinaris. In other instances, again, it is a good plan to peptonize the milk. The cold process is generally preferable, inasmuch as the taste of warm peptonized milk is so unpleasant to the average alcoholic that he will usually reject it. It is advisable to add the peptonizing powder to the milk just before the latter is administered. Sometimes it is necessary to abandon whole milk and to give the patient skimmed milk or buttermilk. With regard to the amount of the milk, it is best to begin with a very small quantity, say three or four ounces, given at intervals of two hours. Many patients who cannot take milk in large quantities can take it in small amounts at short intervals and digest it without difficulty. It will also be noticed that the quantity of milk thus administered in twenty-four hours is insufficient to satisfy the wants of the patient. In two or three days, as a rule, especially if the intestinal tract has been thoroughly emptied by the administration of calomel and salts, the patient becomes very hungry and accepts the small doses of milk eagerly. The amount of milk should then be gradually increased, a half-ounce or an ounce being added to each dose daily until a quart and a pint or more are given in the twenty-four hours.

It will be found expedient in a very few days, at most four or five, to begin with solid food; we should begin, of course, with small quantities. It may consist of soft-boiled eggs, Hamburg steak, boiled rice, stale bread, etc. Little by little the patient may be brought up to a full diet, the milk at the same time being increased. In other words, we apply to the treatment of an alcoholic patient the general principles of diet in the rest cure. Very soon it will be found that the patient is taking a very large amount of food, and that his condition is rapidly changing for the better. The nervousness resulting from the withdrawal of the alcohol subsides and the desire for the latter diminishes. His spirits

also rapidly improve, the depression disappears, and he becomes bright and cheerful.

During all this time, it must be remembered, the patient is receiving daily full general massage and sponge, shower, or spray baths, while the muscles are stimulated by electricity—usually by the slowly interrupted faradic current. As the case progresses, Swedish movements with resistance are added. Soon it becomes necessary to permit the patient to leave his bed for small portions of time daily, until at the end of five, six, or more weeks he is up the greater part of the time. As soon as this is the case, calisthenics and other room exercises are instituted. Subsequently, according to the progress of the case, these measures should be followed by exercise in the open air—always, of course, in the company of the nurse.

Occasionally it is possible to conduct the entire treatment without the use of drugs; but, as a rule, the latter may be advantageously employed. Indeed, most frequently they are indicated. They are roughly grouped into three categories: (1) Those indicated by the symptoms arising from the withdrawal of the alcohol; (2) those indicated by the deranged visceral functions; and (3) those which are tonic, stimulating, or antagonistic to the action of alcohol.

The symptoms which arise upon withdrawal consist especially of markedly increased nervousness, of insomnia, and sometimes of headaches. As a rule, the indications can readily be met by the exhibition of the bromides. These may be given in doses of from 20 to 40 grains every four hours. The insomnia may be combated by trional (gr. xx) and, if this be not efficacious, by sulphonal (gr. xv to xx), veronal (gr. x), or scopolamine (gr. $\frac{1}{100}$). The use of morphine is unjustifiable. Chloral may be used, but it had better be avoided. Regarding the latter, my views are in accord with those of House.

As already stated, there is almost always present a gastric catarrh, and this must be taken into consideration not only in the diet, but also in the medicines prescribed. Silver nitrate (gr. $\frac{1}{4}$) combined in pill form with extract of hyoscyamus (gr. $\frac{1}{4}$) and administered three times daily a half hour or twenty minutes before meals, has, as a rule, a very happy action. Occasionally, however, lavage is necessary, though this, even in severe cases, need not be continued very long. Occasionally the morning nausea and vomiting of chronic alcoholics is very troublesome; but, as a rule, it readily subsides. Sometimes small doses of calomel are indicated, and in others sodium phosphate can be given with advantage. The latter is best administered in hot water early in the morning. At other times it may be given in an effervescent solution and repeated several times daily. Small doses of saline laxatives are also frequently of service during the first week or ten days of treatment.

The third category of drugs, as already stated, includes those which are tonic, stimulating, or possibly antagonistic to the action of alcohol; and it is unfortunately to these more than anything else that attention has been directed both by medical authors and by the advertising pretenders of specific cures. I do not deny that some of them are of

value—in fact, I not infrequently make use of them; but it cannot be too strongly insisted upon that they should not constitute the main factor of the treatment. They are merely adjuvants, and if employed at all should be selected and adapted to each particular case. The drug most commonly resorted to is strychnine. As a rule, it should be employed in moderate doses, say gr. $\frac{1}{50}$ or $\frac{1}{40}$ three times daily; although occasionally much larger doses, gr. $\frac{1}{20}$ or even $\frac{1}{15}$ (Dana), may be given. In my experience, however, large doses overstimulate and tend to increase the nervousness of the patient. There can be no doubt that in most cases strychnine is beneficial, and that it markedly diminishes the depression of the period of withdrawal, and may even tend, as is claimed by Phelps, to impair the appetite for alcohol. Though it has not in my experience so valuable a property, no harm can be done by its use, especially in moderate doses. In many cases we must admit that its use is followed by most gratifying results. Combemale points out that it is contraindicated when there are episodes of excitement, delirium, or symptoms indicative of nerve-cell degeneration, or when there is present obvious disease of the liver or kidneys.

Another drug quite frequently used is atropine. Its stimulating qualities are apparently of much service in many cases of alcoholism. Like strychnine, it appears to lessen the depression caused by the withdrawal. It seems to diminish especially the distressing epigastric and sinking sensations from which alcoholics suffer. It should be administered hypodermically in doses varying from gr. $\frac{1}{150}$ to $\frac{1}{100}$ or more, three times daily, and preferably with strychnine. Clark regards the combination with strychnine as almost a specific. He maintains that while strychnine acts as a nerve tonic, the atropine has a special aptitude for decreasing the appetite for alcohol. Carter also regards atropine as of special value. He declares that atropine given three or four times a day will produce a great distaste for alcohol in from one to five days; that whisky becomes repellant as regards both sight and odor, and that its taste becomes intolerable, producing nausea. While this position is somewhat extreme, there can be no doubt that in cases in which there is marked depression with coldness and clamminess of the extremities, the drug is extremely valuable and it is not impossible that by combating these symptoms atropine may indirectly lessen the craving for alcohol. Bolton re-affirms the benefit of giving both strychnine and atropine.

A remedy that I have myself made use of in many cases during the last few years is thyroid extract. Every now and then we meet with an alcoholic subject who presents symptoms suggestive of thyroid deficiency, and it is exceedingly probable that in such cases one of the effects of the alcohol is the stimulation of the thyroid gland. I have in such patients time and again observed a marked improvement not only in the nervous symptoms presented by the patient, but in the decided diminution and often in an entire subsidence of the craving for the alcohol.

I consider this point of great importance. Moderate doses of

thyroid extract do no harm, and there is no reason why a trial should not be made of it in every case.

Among other medicines that are of use from time to time we should mention arsenic, iron, and bitter tonics. As regards the latter, we should be careful, of course, not to prescribe them in the form of tinctures. As a rule, their exhibition in pill form, with or without a small quantity of capsicum, answers every purpose. Arsenic, if given at all, should be in the form of Fowler's solution, and should be given well diluted for fear that the chronic gastric catarrh almost invariably present may be aggravated. I have found it of distinct value, especially in the latter part of the treatment. If iron be indicated, it should be exhibited in the form of a peptonate, preferably associated with manganese.

A drug that has been brought into great notoriety in connection with alcoholism is the chloride of gold and sodium. Many years since as "bichloride of gold" it was heralded far and wide by advertising pretenders as a specific for alcoholism. As a matter of fact, the drug is almost inert, its action being that of an extremely feeble tonic and alterative unless it be given in large doses, when it acts as a gastrointestinal irritant. Notwithstanding, there are not wanting medical writers who vaunt its merits—*e. g.*, Oliver Edwards, who ascribes to it not only peculiar specific properties, but also declares that it brings about refreshing sleep and other equally remarkable things. It is very probable that the virtues attributed to the gold salt are really to be attributed to the concomitant use of strychnine and atropine. Carter is evidently of a similar opinion when he says that the antagonism existing between atropine and alcohol is the real basis of the gold cure. Apomorphine also is occasionally used in the treatment of alcoholism, especially in systems of treatment in which the patient is allowed all the alcohol he desires. If, in spite of the administration of strychnine and atropine, the patient continues drinking, apomorphine, $\frac{1}{10}$ of a grain, is given hypodermically at such times as the alcohol is taken. How unscientific this method is need not be pointed out. The same is true of any method of treatment which involves the substitution of another drug, such as morphine, cocaine, or chloral for the alcohol; such practice cannot be too strongly condemned.

I am in the habit of applying to every case so far as possible the general principles of the rest treatment, and employing strychnine, atropine, and other drugs only when indicated. It is unscientific to treat every case by a routine method. In cases treated on rest principles it will almost always be found, long before the treatment has been completed—in fact, often before it is well under way—that the patient's appetite for alcohol has entirely disappeared. It will be found, further, after the treatment has been completed, that the tendency to relapse is very slight. It is all important, of course, to guard the patient against exposure to fatigue, alcoholic subjects being very readily exhausted. This fact should be constantly borne in mind when the time comes for the patient to resume the ordinary duties of his vocation.

The greatest difficulty is presented by those cases in which there

is a strong hereditary or neuropathic element. These are the cases in which drunkenness comes on in periods or well-defined attacks. It must be frankly confessed that in many cases of this kind nothing short of forcible intervention and restraint is efficacious, such as legal commitment under an Act of Inebriety, as above described. In every case, however, a thorough trial of thyroid extract should be made, and if, in addition, it be possible to induce a periodic drinker to submit to a prolonged course of rest treatment, followed by exercise, the danger of the recurrence of the attacks will be lessened. At any rate, in the management of such a case, everything should be done toward keeping the organism at as high a physiological level as possible, paying careful attention to every function. We should be careful, further, to point out to such a patient the danger of subjecting himself to severe nervous or other strain, and to enforce as much as possible such a regularity of living that abundant time is given for sleep and for the digestion of food.

In treating alcoholics it is important also to study special symptoms, such as the neuralgic pains and headaches which they present, while one must also be on the outlook for signs of actual disease, either of the nerve centres or of the peripheral nerves; more especially multiple neuritis and the alcoholic psychoses. These complications will demand various additions or modifications of the general plan of treatment. It is remarkable, however, how favorably they are influenced by rest. Mental impairment, as indicated by loss of memory, feebleness of will and judgment, and impairment of the moral sense, is capable of great improvement, and this is also true in a sense of the alcoholic insanities.

Of late years *hypnotism* has been suggested as a mode of treatment for alcoholism, more especially by Forel. Of its efficacy I have no personal knowledge. It is very doubtful whether any method of treatment which fails to recognize fully the pathological groundwork underlying the alcoholic habit can be successful. Certainly, in all but very slight cases hypnotism can be no more efficient than in actual organic diseases. Further, as Crothers points out, alcoholics are, as a rule, very poor subjects for hypnotism. Notwithstanding, suggestion and hypnotism still have their advocates, *e. g.*, Bonne, Stegmann, Mason, and Hilger. Bonne speaks of the ordinary application of suggestion to alcoholics, while Stegmann, who used formal hypnotism, appears to have had rather an indifferent result. Of 28 cases, 5 withdrew in the first week, 16 did not become entirely abstinent, and the remaining cases absented themselves for varying periods of time. Mason believes that mental influences are most important, and it cannot be denied that in many cases such influences play a major role. However, while we should endeavor to bring our patient under the persuasive and stimulating influences of wholesome suggestions and advice, moral and mental, it behooves us first to see to it that he is physically well and that the causes operating to maintain the habit are set aside.

MORPHINISM.

The treatment of morphinism resolves itself into the treatment of the habitual and of the occasional users of the drug. There are some patients who, like the periodic alcoholics, make use of morphine or of opium only at certain periods, and then again voluntarily abandon the drug. It is not an uncommon thing to find that persons who suffer from recurring attacks of headache or neuralgia, or from menstrual troubles, are also periodic users of morphine. Women especially are prone to form such a habit. However, whether the drug be used occasionally or periodically, the problem of treatment remains essentially the same; but, as can be readily inferred, the treatment of the periodic users of the drug is far more difficult than that of those who use the drug continuously. In this connection it may also be pointed out that it is, as a rule, less difficult to treat successfully a patient who uses relatively large quantities of the drug, but has done so for a short time only, than one who uses only small quantities, but has used them for many years.

Various methods of treatment are in vogue, all of which, however, lay special stress upon the method of withdrawal of the drug. For instance, some writers advise immediate withdrawal, others rapid withdrawal, and others very gradual withdrawal. Thus, Gilles de la Tourette advised gradual withdrawal if the patient had been taking relatively large doses, say 5 to 6 grains daily, and sudden withdrawal if the patient had been taking less than 5 grains; while Comby advises invariably sudden withdrawal. According to my experience, it is best at first not to consider the question of withdrawal at all, but merely to institute such general measures as have been indicated in the section on Alcoholism. Here, again, no treatment is so efficacious as that of full rest methods. Partial rest methods fail. Full rest methods, on the other hand, are crowned with success. Isolation is absolutely imperative. No one should have access to the room of the patient save the nurse and the physician. No letters, packages, or newspapers should be admitted to the room under any pretext. Patients practise all sorts of devices to secure possession of the drug. Especially do they attempt to bribe the servants. It is remarkable, also, to what extent friends and relatives will enter into collusion with the patient to supply him with the stimulant, fearing that the doctor is practising great cruelty and is withdrawing the drug too rapidly. Vigilance in such cases cannot be too great. As in the case of alcoholism, the patient should be placed in bed, should be carefully isolated, and should be placed upon a diet especially adapted to the case—one which contains large amounts of milk, vegetables, and fruit, and a relatively small amount of meats. Morphinists, as a rule, have a diminished appetite, and especially for meats. The remarks already made in regard to the diet in alcoholism apply with but slight modifications here. As a rule, the white meats (fish, oysters, breast of fowl, etc.) are well digested, and are found more

beneficial than the red meats (beef, lamb, etc.). In addition to the rest and the special feeding, bathing, massage, and electricity should be systematically employed.

It is my practice not to begin withdrawal of the drug until rest treatment is fully under way. One must remember that the morphine habitué labors under an excessive fear lest the drug be withdrawn too soon. Besides, sudden withdrawal always implies a period of frightful physical and mental suffering. Further, the patient is, as a rule, intensely distrustful. I know of no class of patients with whom it is more difficult to establish friendly relations or in whom it is more difficult to inspire confidence. However, if the patient learns after his first few days of rest and isolation that he is still receiving his hypodermic injections, or that he is still being allowed his usual quantity of laudanum or opium, confidence sooner or later asserts itself, especially as the physical comfort resulting from the bathing, massage, and proper diet soon becomes pronounced. My practice is almost invariably that of very gradual withdrawal. The withdrawal should be so slow at first that the diminution of the dose is practically imperceptible; later on the reduction may be more rapid. If the patient has been in the habit of receiving hypodermic injections, it is my plan not only to reduce the dose gradually in the manner indicated, but also to begin adding to the injection small doses of strychnine sulphate, say $\frac{1}{50}$ of a grain, and if the skin be very moist, small doses of atropine sulphate, say $\frac{1}{200}$ of a grain. As the dose of the morphine is diminished, hyoscine or scopolamine should be added to the hypodermic injection, first in small and then in larger doses. As a rule, the atropine may be discontinued if the scopolamine be given. There can be no question that hyoscine and, more especially, scopolamine greatly relieve the suffering of the patient and keep him much quieter than he would otherwise be. There is, of course, no danger of the formation of a hyoscine or scopolamine habit, and besides we are in complete control of the situation. The physician should be especially cautioned not to make use of cocaine during the withdrawal, or, in fact, at any time, inasmuch as the patient may sooner or later acquire the cocaine habit, with results equally disastrous. Besides, a large number of patients that come under our care for the morphine habit have already acquired the cocaine habit. The same remarks apply to the use of alcohol. Many of our cases, indeed, are instances of the "triple habit," namely, morphinism, cocaineism, and alcoholism.

My reason for withdrawing the drug in the gradual manner described above is not only to diminish the sufferings of the patient, but also to prevent the onset of serious symptoms. Every now and then, if the drug be abruptly withdrawn, signs of collapse, diarrhea, sweating, cardiac weakness, and dyspnea, with excessive prostration, may set in. In other cases, again, mental symptoms resembling those of confusional insanity make their appearance, the patient becoming hallucinatory, delusional, and finally delirious. Sometimes the mental disturbance is much less pronounced, and consists of a confusion in which the patient is more or

less expansive, and with but little obtusion to the surroundings, as in the case reported by Abraham. Mental symptoms, on the whole, are not likely to make their appearance if the drug be withdrawn in the manner indicated and under fully established rest conditions.

The treatment of the morphine habit by the rest methods should be continued for a very long period. In my experience, the period which is sufficient for ordinary cases of neurasthenia or hysteria is totally insufficient for cases of morphinism. A course of three months of treatment is, as a rule, absolutely demanded, and in many patients the treatment should embrace five, six, or even seven months. I do not mean to imply that the patient should be kept in bed during all of this period, but that full rest methods should be kept up for from three to four months, and after this a partial rest treatment should be instituted, the patient being up and out of bed and exercising out-of-doors daily for some three or four hours. In cases so treated I have met with most gratifying results. Success, it need hardly be stated, is still further assured if the patient's nurse accompany her to her home or elsewhere and remain with her for a period of several months longer. If practicable, the entire length of treatment under the supervision of the nurse should extend over a year. In no class of patients is relapse so apt to occur as in morphine cases, and it is for this reason that every possible precaution should be taken, provided the patient's means permit it.

With regard to the management of morphine cases, subsequent to the rest treatment, the general principles already indicated in the section on Alcoholism are applicable here. Everything should be done in the way of proper diet and exercise to keep the patient's health at as high a level as possible. But here also it is important to avoid fatigue, and especially strain, excitement, and worry. Many cases presenting special difficulties are cases in which the habit has been acquired for the relief of a painful affection which still continues, as, for example, a persistent neuralgia, frequently recurring headache, or painful menstruation. It is needless to point out that every effort should be made to discover and, if possible, eradicate the cause of the painful affection, whatever it may be, treating the headache or neuralgia upon such principles as are indicated; or if functional or organic disease of special structures be present—*e. g.*, pelvic disorders in women—instituting such means, medical or surgical, as are necessary.

Because morphine patients are so untrustworthy, and because the means of obtaining the drug save under absolute isolation are so many, the physician should carefully watch the patient in order to learn whether the drug is really being withdrawn. Absolute supervision is possible only under absolute isolation, and yet, by the most unexpected means, the patient may be placed in possession of the coveted stimulant. However, if the quantity of the drug administered is really being diminished, certain symptoms inevitably make their appearance. They are, first, restlessness, which may become very marked, and is accompanied by more or less insomnia. The patient also yawns a great

deal or sneezes, complains perhaps of having caught cold, or perhaps has an attack of difficult respiration, simulating asthma. In addition to restlessness, the patient manifests signs of fear, complains of a sense of oppression, declares himself dissatisfied with the treatment, and insists upon going home. Involuntary movements of the legs and arms also make their appearance, the limbs being thrown about the bed. At times this is merely due to restlessness; at other times distinct involuntary jerkings make their appearance. Intention tremor also becomes evident. When, for instance, the patient attempts to pick up a glass of water, it is noticed that he trembles decidedly. Sometimes, instead of an asthmatic attack, all the symptoms referable to a cold in the head or a spasmodic cough may make their appearance. Sometimes vesical tenesmus is noticed. Palpitation of the heart may also be evident, or the patient may complain of fluttering sensations in the precordia. Occasionally quite unusual symptoms are noted, such as a transient motor aphasia observed by Belletrud.

It is exceedingly probable that the long-continued ingestion of the morphine gradually results in the production of an antitoxin, so that little by little the patient becomes more and more tolerant of the drug. Indeed, this tolerance, or relative immunity, which at times is extraordinary, can be explained on no other ground. It would seem that the symptoms arising during the withdrawal of the drug are largely due to the unantagonized action of the accumulated antitoxin; for the vomiting, the diarrhea, the sweating can only be regarded as efforts on the part of nature at elimination. Similarly, it is extremely probable that the nervous disturbances, the delirium itself, are the result of the now unopposed action of this antibody upon the nerve centres. It follows, as a matter of necessity, therefore, that with the withdrawal of the morphine a definite group of symptoms must make their appearance, and in exact proportion and intensity to the withdrawal of the morphine. It stands to reason, therefore, that if none of these symptoms are present, and if the patient continues comfortable and in good spirits, sleeps well, and is contented with his surroundings, he is obtaining the drug surreptitiously. It should be remembered that even under very gradual withdrawal some of the symptoms mentioned above make their appearance, and may, indeed, become so marked as to necessitate for a time a return to a larger quantity of the drug. No picture is more alarming than that often presented by morphine patients in the stage of withdrawal, especially if the depression produced by the vomiting and diarrhea be accompanied by mental confusion and delirium. These symptoms cannot be relieved by other remedies, and a recourse to morphine for a time is not only indicated, but is really the only course to pursue. The history of withdrawal in a confirmed case of morphinism is, in my experience not a steady and unbroken decrease in the quantity of the drug, but consists of a series of diminutions, the progressive decrease being every now and then broken by a return to a slightly larger quantity. The detailed method of diminution depends largely upon the individual case under treatment. As a rule,

I continue for a number of days the quantity of morphine which the patient habitually takes; I then begin the diminishing of doses given in the early portion of the day; those given at night are continued in full quantity for a somewhat longer period. This is contrary to the practice of others, who begin by diminishing the evening doses. In my experience, cutting off the evening doses makes the patient restless and sleepless; while the diminution of the morning dose, though producing restlessness, is not attended by the great disadvantage resulting from insomnia and its attendant evils. No hard and fast rule can, however, be said to apply. There are some cases in which the early morning depression is so great that the maximum dose must be given early in the day; diminution must, of course, in such cases take place in the evening. The patient should be given the drug when he needs it most, and it should be first diminished or withdrawn at those periods when he needs it least. Inasmuch as morphine injected hypodermically is eliminated by the stomach and is subsequently reabsorbed by the intestines, Hitzig suggested that in treating morphinism we should systematically wash out the stomach. This seems to me to be an unnecessary precaution. The procedure is one that adds greatly to the distress from which the patient already suffers, and it is doubtful whether morphine thus gotten rid of is really large in amount. Special methods of withdrawal are also advocated, as, for example, that of Jennings. Jennings slowly withdraws the morphine and then substitutes for hypodermic injections rectal injections, and for the latter he finally substitutes injections of sodium bicarbonate without the patient's knowledge. This method has nothing special to recommend it. The method of Deutsch, of substituting rectal injections of opiates for hypodermic injections, appears likewise to lack special value. McBride practises gradual withdrawal without substitution, though he gives large doses of bromide. The use of dionin (ethyl morphine hydrochloride), recommended by Fromme, as well as that of heroin, recommended by Kandel, appear not to offer any special advantages.

As already stated, during withdrawal we should make use of hyoscine or scopolamine and free use of hypodermic injections of strychnine sulphate. As a rule, the scopolamine, acting in part like atropine, prevents excessive sweating. Should it not control the skin, small doses of atropine may be added. As in the management of alcoholism, the dose must be adapted to each case. In morphinism much larger doses of these drugs are tolerated. However, in many cases it is possible to bring about withdrawal without their use. Occasionally it is a good plan to use digitalis or strophanthus. As the treatment progresses and during the convalescent period, bitter tonics, mineral acids, iron, arsenic, or malt and other nutrients may be added as seems expedient.

Among drugs to which special virtue in the treatment of morphinism has been ascribed we should mention *sodium phosphate*. It has been especially advocated by Luys. He believes that it has a supporting action on the nervous system and should be given hypodermically. Beyond purely theoretical considerations, the drug has nothing to

recommend it. Cocaine, which is recommended by Skene, Mattison, and by Keugla, is merely a makeshift substitute, and should not be resorted to. Caffeine, also recommended by some writers, may occasionally be used in cases in which withdrawal is followed by great depression, or in cases in which the early morning depression is very marked. It should not be given toward evening for fear of adding to the insomnia. Insomnia and restlessness not infrequently demand the use of the bromides. Ammonium bromide may be given in doses of thirty to forty grains at intervals of four hours. In persons who have used morphine in very large doses the bromides are, however, of little avail. Trional, sulphonal, or veronal may also be employed, or various combinations of these drugs, more especially veronal with sulphonal, proves efficacious. We are rarely required to fall back upon chloral. The hot bath offers a harmless and very often a very efficient method of combating the insomnia.

Suggestion, advocated by some writers, with or without hypnotism, is of little or no value in the treatment. Hirt, for instance, treated cases outside of institutions, if the daily dose was not greater than 0.25, 0.50, or at most 0.75, with the aid of hypnotism. He placed a reliable female nurse in charge of the patient. The morphine was then suddenly withdrawn. Sleep was produced by chloral or trional, or by warm baths. In four or five days treatment by hypnotism was begun. Hirt stated that only a slight degree of hypnosis was required. The treatment extended over a period varying from twenty-one days to eight months, but recovery could be regarded as established only in one and one-half to two years after the last hypodermic injection had been given. Certainly the method has nothing to recommend it on the ground of economy of time. Besides, success seems to be very doubtful. It cannot but be greatly inferior to treatment directed primarily to the reestablishment of the general health, such as is embodied in the application of rest treatment. W. W. Winthrop, of Fort Worth, Texas, some years ago called attention to the employment of "husa" as a remedy for the cure of the opium habit. Husa appears to be an unclassified, or at least unidentified, plant found in the Everglades of Florida. According to Winthrop, it is a diffusible stimulant, causing gentle excitement, followed later on by sedation and sleep. From three to four months are necessary to effect a cure. It appears also that precautions must be taken to prevent the formation of a husa habit. The treatment of the opium habit by this means appears to be open to the same objection as are other methods which depend upon the substitution of one drug for another.

Among special remedies suggested from time to time is brucin hydrobromate, recommended by Fromme, who administers this remedy by the mouth during withdrawal. Pressey recommends static electricity. He also dwells upon the fact that in gradual withdrawal there are no vomiting, no diarrhea, no hallucinations. Wagner calls attention to the efficiency of hyoscine in alcoholism, morphinism, and cocaineism. Strangman reports a case of laudanum habit in which the amount taken

daily was very large, two wineglassfuls, treated successfully with atropine and strychnine. Rochester gives an interesting account of his treatment of opium smoking. He withdrew the poison without giving any substitute. The abstinence symptoms were the same as in morphine withdrawal. He states that sudden withdrawal is without danger; the diarrhea is of short duration.

Based upon the idea of the formation of an antitoxin as a result of the persistent use of the drug, Hirschlaff has endeavored to produce an antimorphine serum which he calls eumorphol or "Morphium heil Serum." Experiments on animals do not yield satisfactory proof of the value of this serum. He reports, however, four cases of morphinism treated by withdrawal plus the administration of eumorphol, which he regards as favorable. Morgenroth warns against the reported successful results of Hirschlaff. He states that no protection or immunization is offered by the antitoxin, and claims, indeed, that normal serum will do the same.

A discussion of the treatment of morphinism is perhaps incomplete without referring to one of the means by which the habit is often brought about and perpetuated, a means, moreover, which is largely under our own control. A painful fact thrusts itself upon us in that the morphine habit generally has its origin in the prescription of the drug by a physician for some transient affection. Every prescription containing morphine for the relief of pain should be marked above the physician's signature with the imperative order not to be renewed. Refilling a prescription so marked renders a druggist liable to prosecution, and physicians can by this simple expedient exercise a certain amount of control over their patients. Further, prescriptions for the relief of pain should be for a few doses only, and the patient himself should be warned against the unnecessary repetition of the dose.

Another and prolific source of the morphine or opium habit is the ease with which narcotics can be purchased by the layman; and although laws exist which forbid the dispensing of poisons and narcotics without physicians' prescriptions, violation of these laws is a matter of very common experience. Patients also frequently procure a hypodermic syringe in order to be able to indulge their craving without hindrance. Unfortunately it must be admitted that among the patients are also found physicians.

COCAINISM.

As mentioned in the preceding section, cocaineism is sometimes acquired as a concomitant of the morphine habit; a patient often attempts to reduce the amount of the morphine by the aid of cocaine. Frequently he also resorts to alcohol to enable him to combat the habit, and this leads to the formation of the triple habit already spoken of. A far more frequent cause of the cocaine habit, however, is the use of the drug in the treatment of affections of the nose. Not only is cocaine applied by the surgeon preparatory to operation, but it not infrequently happens

that the patient secures a solution of cocaine and soon begins to use it very freely. Sometimes the patient applies the cocaine with a pledget of cotton or with a spray, just as he has seen his physician make the application, and may continue the practice before he realizes its danger. One of my patients did not long content himself with the pledget or spray, but soon began pouring the solution down through the nose into the pharynx, in this way taking large amounts of the drug daily. Every local application is, of course, followed by a certain amount of general action. After its use over a large mucous surface, such as the nasal chambers, the patient experiences not only local anesthesia, but a comfortable sense of warmth and well-being diffused over the body. The nerve centres are stimulated, especially if the dose has been large, very much as they are stimulated by alcohol, save that the stimulation is far more intense and sudden.

A patient upon whose nasal chambers cocaine has been freely used, soon becomes talkative, often boastful; but in a little while fatigue and relaxation supervene. Soon he experiences a need for the repetition of the dose, and little by little the habit is established. If the drug be withdrawn for some time, or if the patient fails of access to the stimulant, he is seized with a feeling of great discomfort, of marked oppression, of faintness, palpitation, and general nervousness. There is, in addition, a marked mental irritability, which is manifested by sharpness and shortness of speech and jerkiness of manner.

The cocainist soon becomes unable to attend to his business. He becomes readily and excessively fatigued. In a short time also it is noticed that judgment and memory become impaired, and his regard for truth becomes as small as that of the morphinist. Often he is full of business which is never completed; he is talkative and boastful, but neglects his obligations. At the same time it is noticed that he is pale and haggard; that his general nutrition is much impaired, and his weight is below normal. Often he presents a picture of premature senility. His reflexes are exaggerated. His movements are those of unrest and constant change of position. At times his muscles are the seat of spasmodic twitchings. His pupils are dilated. Frequently there is tremor of the tongue and sometimes of the hands. His pulse is rapid, and he frequently suffers from palpitation. His skin is likely to be cold and moist. He sleeps but little—often, indeed, insomnia persists for days. In addition he may present symptoms of mental confusion and even of delirium. Sometimes he is the victim of delusions of persecution. At other times he becomes, if married, insanely jealous, and may, as in alcoholism, entertain the delusion of marital infidelity. Not infrequently hallucinations make their appearance, visual and auditory, and especially hallucinations referred to the cutaneous surface. The patient frequently believes that there are vermin or fleas upon his person, or in his bed or about his room; and he often spends a large part of his time in bathing, rubbing, scratching, or in making efforts to rid himself of the imaginary pests. So frequent is this hallucination of cutaneous sensibility that a patient presenting it is said to suffer from the “cocaine bug.”

During the withdrawal of the drug these symptoms become much exaggerated.

Contrary to what one might expect, it is, as a rule, practicable to withdraw cocaine far more rapidly than either morphine or alcohol. It is true that insomnia, palpitation, dyspnea, and collapse are liable to occur, but they can be much more readily controlled. As a rule, I practise immediate withdrawal; the experience of Norris is entirely my own. The bromides are very efficacious in combating the symptoms. Many cocaineists sleep spontaneously after the mere withdrawal of the drug, but it is usually a good plan to give moderate doses of trional or sulphonal at night. In the early morning coffee may be given to lessen the depression.

In cases in which morphinism and cocaineism co-exist the cocaine may usually be withdrawn at once. The morphine should, however, be withdrawn in the gradual manner already described. In cases in which the alcohol habit is also present, it is expedient to withdraw the cocaine at once, the alcohol rapidly, and the morphine slowly. The morphine distinctly overshadows the other drugs, and, as a rule, it had best be continued in full doses for a number of days. Later it may itself be gradually diminished. In other words, the treatment of this "triple habit" resolves itself sooner or later into that of simple morphinism.

It cannot be too strongly insisted upon that rest and isolation, as detailed in the sections on Alcoholism and Morphinism, apply equally to the treatment of cocaineism. Full rest methods embody the very best conditions for the treatment of such a case. Indeed, under other conditions the physician is never certain of the progress that is being made. The cocaine patient is even less to be trusted than the morphinist. He is, when the habit is confirmed, tricky, treacherous, and utterly untrustworthy. I know of no class of cases more difficult to control. Confinement in bed under the supervision of a trained nurse, with strict isolation, presents practically the only favorable prospect of cure. As in the case of morphinism, this isolation should be practised for from two to three months or longer. The general principles already indicated with regard to the use of tonics in the convalescent period of morphinism apply equally here. We should remember that our patient is below weight, and that he presents the symptoms of nervous exhaustion to a profound degree.

CHLORALISM.

The chloral habit is far less common than the other drug habits. Like morphinism, it frequently owes its inception to a prescription by a physician for some transient disorder, the patient renewing the prescription without the physician's knowledge or consent. Little by little the patient becomes accustomed to the drug, and soon cannot sleep without it. It is a poison which is depressing to the heart and vasomotor apparatus. Dyspnea, vertigo, and general sense of weakness are among

the symptoms likely to be present. In well-established cases there are marked nervousness, marked insomnia, and a certain degree of mental weakness as manifested by loss of will-power and failure of memory. In some cases an emotional depression is present which may simulate melancholia. The patient is weak, his movements are tremulous, and he frequently complains of palpitation of the heart.

The treatment of chloralism is to be carried out on the lines already indicated. Care should be taken, however, not to withdraw the drug too suddenly, inasmuch as all of the symptoms of its use become rapidly accentuated by sudden withdrawal. Other narcotics, such as trional or sulphonal, may be gradually substituted, but must in turn be soon withdrawn. At times even morphine must be resorted to. The danger is, of course, that the patient may acquire a new habit. Occasionally he suffers so severely from feeble action of the heart that it is necessary to prescribe digitalis. Alcohol should be avoided because the relief which it affords is so great the patient is in great danger of acquiring the alcohol habit. However, the general principles already indicated in the previous sections should be closely followed. Isolation, absolute rest in bed, with massage, bathing, forced feeding, and perhaps the use of electricity, should be instituted. The drug should always be withdrawn very gradually, and, if possible, without the substitution of any other narcotic. Any treatment which embodies the substitution of some other narcotic for any length of time is in danger of failure. Strychnine, atropine, and digitalis may be used to tone up the weakened heart and vasomotor apparatus. The treatment should never be entered into without a full appreciation of the dangers of withdrawal. Finally, the withdrawal should never be begun without full isolation, because, in my experience, the patient is in danger of beginning the free use of alcohol, being driven thereto by the intense psychical and physical depression.

OTHER DRUG HABITS.

Persons suffering from insomnia frequently have recourse to other drugs, especially the more modern hypnotics, such as *trional*, *sulphonal*, or *veronal*. It cannot be claimed, however, that such habits are of frequent occurrence. By far the larger number of cases of drug habit suffer from morphinism and cocainism. Occasionally, however, the patient forms the habit of taking such an unpleasant drug as *paraldehyde*. The patient is very apt to take the drug with whisky, or may soon abandon the alcohol entirely for the paraldehyde. As a rule, the patient reeks constantly from the unpleasant odor of the drug. It is an intense irritant to the mucous membranes, and if it has been long continued, it may lead to marked disturbances of nutrition, such as ulcers of the mucous membranes and skin eruptions.

Less frequently, even other drugs rarely prescribed by physicians, such as *chloralamide*, are used by the patient. At times ether is the intoxicant to which the patient is addicted. Curiously enough, some persons form a *phenacetin* or *antipyrin* habit.

The general principles here indicated are, of course, to be followed in the treatment of a drug habit, no matter what its cause. These principles consist in (1) the isolation of the patient in such a manner that his access to the drug, save when administered by physicians, is absolutely cut off; (2) the employment of full rest methods with the application of all the procedures which this method entails—absolute rest in bed, careful regulation of all of the functions, especially of digestion, full feeding, bathing, massage, and, it may be, electricity.

PART VII

THE TREATMENT OF DISEASES OF THE GENITO-URINARY APPARATUS

NEPHRITIS, ALBUMINURIA, CHYLURIA, LITHURIA, OXALURIA, AND PHOS- PHATURIA

BY JAMES TYSON, M.D.

ACUTE NEPHRITIS.

THERE are cases of acute nephritis so mild as to require no treatment other than rest in bed and warmth, with a milk diet, and it is well in all cases not to precipitate drastic treatment at the outset unless it be demanded by urgent symptoms, such as uremic convulsions or coma or suppression of urine. In the mild cases referred to the kidney gradually resumes its normal state and function, the urine becomes normal, edema, which in such instances would be moderate, disappears, and health is restored in the course of a few weeks.

In the severer forms in which scanty, highly albuminous, and even bloody urine and dropsy may be added, the same prompt rest in the recumbent position is imperative, and the same simple diet as in the milder cases. In such cases, however, more active medical measures are necessary. The first of these is a brisk purge. Of purgatives, the salines are most suitable because of the watery stools they produce, and there is none better than magnesium sulphate, of which from two drams to a half-ounce may be given dissolved in half a glass of water. But Rochelle salt, sodium phosphate, magnesium citrate, or any of the numerous natural mineral waters of which sodium sulphate is commonly the active ingredient, such as Apenta water, Carlsbad water, Friedrichshalle or Rubinyat water, may be substituted. Sodium phosphate is a popular aperient of this class today. Circumstances must determine whether a single initial dose is sufficient or whether the aperient must be repeated daily or on alternate days.

Diuretics of the saline class should be simultaneously used. Such are the official solution of potassium citrate and solution of acetate of

ammonium (spiritus mindereri) in doses of two fluidrams to half an ounce every two or three hours. To these may be added the cardiac diuretics, tincture of digitalis or tincture of strophanthus, in doses of five to fifteen minims. It is well to remember that both digitalis and strophanthus are drugs which are comparatively slow to act, while their effect is prolonged, as contrasted, for example, with the nitrites, which act quickly but are fleeting in their effect. The former remedies are therefore given in full doses at longer intervals, while the latter should be given in small doses at short intervals. The nitrites are frequently indicated in association with digitalis and strophanthus in acute nephritis to reduce the tension of the bloodvessels which the first-mentioned drugs are disposed to increase. The doses should be $\frac{1}{100}$ grain and upward of nitroglycerin every two to three hours, kept up until the pulse softens and even longer. The nitrite of sodium is said to produce a more permanent effect than nitroglycerin. It is prescribed in one to three grain doses every three to four hours. The tincture of strophanthus produces in a less degree the contractile effect on the arteriole walls and has the further advantage of having a slight tendency to act upon the bowels. Equally efficient and even more efficient when properly made is the infusion of digitalis. It may be given in $\text{f}\text{3ij}$ to $\text{f}\text{3ss}$ doses three or four times in the twenty-four hours. A mixture of spiritus mindereri, $\text{f}\text{3ss}$, and acetate of potash, grain xv, every three hours, has long been used as a diuretic, and has also the advantage of being laxative.

Circumstances may determine the selection of other purgatives. Thus, if the patient be unconscious in uremia, bulky substances cannot be administered by the mouth, and elaterium becomes suitable because of its concentration. A small pill containing $\frac{1}{6}$ or $\frac{1}{4}$ gr. may be carried to the back part of the tongue, whence it will be swallowed. In urgent cases it may be given hourly until the desired effect is produced. The dose of elaterin, the active principle of elaterium, is $\frac{1}{20}$ to $\frac{1}{10}$ gr. Two drops of croton oil may be added to a teaspoonful of plain oil and similarly administered.

Is further treatment necessary? Yes, if the measures recommended fail to remove the symptoms. To this end the skin may be availed of, and especially the effect on it of the vapor or steam bath or the hot pack. Hospitals are usually provided with suitable apparatus to produce sweating, but private families are not likely to be thus provided. In such event a piece of water spouting may be used, one end being introduced under a suitable framework over the patient's body and the other over a spirit lamp or vessel whence steam can be conducted through the pipe under the bedclothing. Such a bath may be given every other day, every day, or even more than once a day. Elimination of the toxic agency, whatever it may be, which causes uremia is also thus favored, though experiments of v. Noorden go to show that the most effective elimination of toxic substances is by the bowels more than by the skin. All channels of elimination should be availed of.

The hot pack consists merely in wrapping each limb in a cloth or piece of flannel wrung out of hot water, and finally wrapping the entire

body in such a wet blanket. To many it is the most agreeable of the forms of sweat baths. The sense of fulness and throbbing sometimes felt in the head during the hot-air or vapor bath is relieved and sweating hastened by a cold compress applied to the forehead. The action of the skin may be availed of by pilocarpin in one-twelfth grain doses every two or three hours, increased if no effect follows these doses.

I am in the habit of applying dry cups to the loins in acute cases when there is pain or tenderness in this region. In children, poultices succeeding cupping sometimes act favorably, and many years ago I read the report of a case in which a poultice made of digitalis leaves applied to the region of the kidney excited the secretion of urine after all else had failed. I have tried it many times without success.

Failing to secure diuresis by these measures, other diuretics may be resorted to. Among these are diuretics of the theobromine class, including theobromine itself. These diuretics are thought to act directly on the kidney or its bloodvessels, and not through the heart as digitalis and strophanthus. They therefore require a certain integrity of the kidney to become efficient. Hence they are better suited to cardiac dropsy, but as there often remains a certain amount of functionally active renal substance, they thus become efficient. Theobromin, although insoluble, is an excellent remedy of its class. It may be given in 7 gr. doses every four hours mixed in water. A more soluble preparation is diuretin, which is a natriosalicylate of theobromine, but it is a nauseating remedy and uncertain in its action. It may be given, however, in doses of 10 to 15 gr. four times a day when other remedies fail. It is best dissolved in a little water at the time of administration. A more reliable and less disturbing preparation of the same class is aceto-theocin, a combination of acetate of sodium and theobromin. It is sometimes phenomenally efficient given in doses of 6 gr. every six hours—four times in the twenty-four hours. Agurin is a similar preparation, but I have had no experience with it. It is said to be more efficient in renal dropsy.

Another diuretic of this class is caffeine, which is trimethylxanthine, while theobromine is dimethylxanthine. Caffeine is not a powerful diuretic, but a clean heart tonic with diuretic tendency. It may be given in doses of three grains every four hours, more or less. It is sometimes exciting, and on this account is suitable when there is a tendency to drowsiness. The citrate of caffeine, being a weaker drug, may be given in 5 gr. doses where one would give three grains of pure caffeine.

Sparteine, the active principle of broom, should not be forgotten. Broom tea was in the past often found an efficient diuretic, but it is an unpleasant one. Now we have its active principle sparteine in the shape of the sulphate. Doses of $\frac{1}{4}$ to $\frac{1}{2}$ gr. so given that not less than 2 gr. are given in the twenty-four hours are often efficient. Larger doses may be given. I do not know of any harmful results traceable to it.

Sometimes in the later stage of the disease the old but erroneously named Niemeyer's pill of digitalis, squill, and calomel acts when other diuretics have failed. The proportions are varied, but commonly $\frac{1}{2}$ gr.

of calomel and 1 gr. of each of powdered squill and digitalis are given every three hours. Nor should Trousseau's diuretic wine be forgotten, composed of:

Contused juniper berries	3x
Powdered digitalis leaves	3ij
Powdered squill	3j
Sherry wine	Oj

Macerate for four days and add of acetate of potash, 3iij. Express and filter, and give a tablespoonful three or four times a day to an adult.

This preparation is better suited to the more chronic forms of the disease.

It has been intimated that milk is the most suitable food in acute nephritis, because of its bland and unirritating qualities and its easy assimilation as well as its composition, which includes a relatively small amount of proteid. It may, however, be supplemented by farinaceous preparations and the cereals, including hominy grits, cornmeal, oatmeal gruel, cream of wheat, arrow root, malted milk, Mellin's food and the like. But while these foods are most suitable, light animal broths may be permitted to break up the monotony of diet, but no concentrated stock soups or beef teas should be permitted, as the proteids and salts contained in these are toxic. Even egg food should be taken in moderate quantity if at all. I have learned from my own experience that while it is scarcely possible to produce an albuminuria in a person with sound kidneys by the ingestion of large amounts of egg, it is quite possible to increase the albumin in persons with diseased kidneys by a like course.

Salt-free and Dry Diet.—*In explanation of renal dropsy*, Strauss in Germany and Widal and Javal in France originated the idea that because of the inability of the nephritic kidney to secrete chloride of sodium, an abnormal quantity of the latter accumulates in the tissues, and that the serum is retained there to hold it in solution, constituting dropsy. As food and the salt added thereto are the source of such salt, it is evident that more favorable conditions are brought by salt-free food. Hence it is advised that only salt-free food be used in renal dropsy. Such food includes eggs, unseasoned meat, unsalted butter and milk, bread without salt, fresh-water fish, potatoes, rice, fresh vegetables, fruits, and chocolate. Milk is regarded as practically salt-free food.

In some cases where there is general anasarca the dry diet suggested by Matthew Hay many years ago in the treatment of cardiac dropsy is helpful in renal dropsy. The task imposed is the removal of serum which infiltrates tissues and occupies serous sacs. It is reasonable to suppose that this is easier accomplished if little or no fluid is added to that already present in the economy, and this is the principle of the dry diet treatment, to ingest as little liquid as possible and to feed the patient on solids as far as possible. As intimated, this is more successful in cardiac than renal dropsy, and the method is embarrassed by the fact that a small amount of liquid is needed in the stomach to make the digestion of solids possible. I have therefore modified this method, using milk instead of solid food, but still in such small quantity that a like effect is produced. My method

is to order two ounces of milk every two hours in lieu of all else. With this limited ingestion of a nutritive fluid we have still practically a dry diet of wholesome nutritious material, and the infiltrating serum of the tissues is therefore drawn upon to apply the needed nutriment. Gradually the serum disappears, the patient becomes more and more hungry, and at this stage decided improvement sets in. As the dropsy is relieved more milk may be added to the diet, and as improvement further continues other suitable food may be added.

At this point I wish to call attention to a measure of treatment which though well founded often leads to aggravation rather than relief. There is a general impression, which is, generally speaking, true, that in renal disease it is desirable to give an abundance of liquid in order to depurate toxic matter from the blood by free action of the kidneys if they can be made to act. Now, where there is dropsy this is more difficult because of the tension of the distended tissues; we already have more liquid in the tissues than we want and they are water-logged, and to give more adds fuel to the flame. Under these circumstances it is often helpful to make an incision an inch long behind each internal malleolus and permit some of the serum to drain off. Enormous quantities are often thus removed, with great relief to the patient, starting afresh also the action of the kidney. Southey's tubes may be used for the same purpose.

Treatment of Uremia.—Uremia is a possible complication of all forms of nephritis, acute and chronic, but as it is more commonly met in association with acute nephritis, its treatment, which is most important, is best considered here.

The exact cause of uremia is still unknown. This much only seems well determined, viz., that it is a condition especially characterized by coma and convulsions, brought about by some toxic substance or substances which the healthy kidney separates from the blood, but which accumulates in the blood in diseased kidneys. It is further probable that such toxic substances are proteid in composition and of the nature of extractives. This much seems to be pretty well settled, that urea, whence the condition takes its name, is not the toxic substance. On the other hand, there is reason to believe that the alloxuric or purin bases, xanthin and hypoxanthin, which are virulently toxic, contribute to the toxins responsible for uremia.

Acute uremia, often ushered in by intense headache or sudden blindness and attended by the coma and convulsions mentioned, requires the promptest treatment. This is simply an enlargement of the treatment above outlined. The kidneys have for the most part ceased to act, and the bowels and skin are the only channels left. The patient is unconscious or in convulsions, and it is not easy to give medicines.

For purgation the most concentrated and therefore the easiest of administration is elaterium or its active principle elaterin. The former may be given to an adult in the shape of a little pill containing $\frac{1}{4}$ gr. carried well back in the throat, whence it is swallowed by a reflex act. Profuse watery stools result. Elaterium is thus thought to aid in the elimination of the uremic poison as well as to aid in reducing the dropsy.

The dose of elaterin, the active principle, is $\frac{1}{20}$ to $\frac{1}{10}$ gr. Instead of the pill or tablet form, either drug may be dissolved in a teaspoonful of water and thus carried to the back of the throat. Instead, a couple of drops of croton oil mixed in olive oil may be similarly administered. It is not worth while to give less than two drops to an adult. In the meantime the bowels may be started by an injection, the patient sweated by a hot air or vapor bath, or, in the absence of facilities for these, a hot pack may be given.

Jaborandi as a sudorific is less employed than it used to be because of the alarming edema of the lungs which it sometimes causes. This commonly follows the administration of large doses of pilocarpin muriate hypodermically administered. A quarter of a grain suffices if it be aided by the simultaneous use of warm covering. Thus aided, a quarter of a grain goes quite as far as a half-grain unaided. Should alarming edema follow the use of pilocarpin, it can generally be controlled by a hypodermic injection of $\frac{1}{100}$ gr. atropine, which may be repeated.

Few realize the amount of excretion by the skin. When stimulated by warmth induced by anything which dilates the capillaries, as exercise, hot air or vapor, about a liter of water can be made to pass through the skin daily, containing much of the nitrogenous end-products of metabolism and of common salt. Herman Strauss showed that in a liter of sweat, under favorable circumstances, fully 6 gm. of common salt can be removed from the body. Von Leube found 2.31 gm. of chlorides in 800 gm. of sweat. These observations are confirmed by others. They acquire additional importance in view of modern studies on the influence of salt-free foods on dropsical transudations.

According to Strauss and von Noorden, from 1 to 2 gm. of nitrogenous matters may be removed through the skin daily. Von Leube found the nitrogen in the urine 2 gm. less on the days in which sweating processes were carried out. These observations too are confirmed. Kovese and Roth-Schulz found 29 gm. of nitrogen and 29 gm. of common salt in the sweat of patients suffering with Bright's disease. Electric light baths appear to have the effect of increasing elimination. Strasser and Blumenkranz found after such baths an increase in the elimination of common salt up to 18 gm., 4 gm. more than were ingested. The same is true of nitrogen elimination and perhaps of other toxic substances. According to Arnold Lorand a liter of sweat can be thus removed from the body in from twenty to twenty-two minutes. H. Strauss, Roth-Schulz, and Kovesi ascertained that the sudorific glands of nephritic patients when stimulated can secrete a liquid that is more concentrated than the blood, and that from 10 to 20 per cent. of the solids in the urine can be eliminated through the skin. Finally, Camerer found 100 gm. of sweat contained 50.6 gm. ashes, 10 gm. fat, and 10 gm. nitrogenous matters, of which, 30 per cent. was urea and 75 per cent. was ammonia.

I do not hesitate to bleed from the arm if the patient has a good pulse. Such bleeding may be advantageously associated with hypodermoclysis or intravenous injection of normal salt solution. In fact, it is hazardous to use the latter unless associated with the former, or unless fluid has

been otherwise removed from the body, as its effect is to increase blood pressure and invite uremia. Associated toxic substance is drawn with the blood, while that which remains is diluted by the harmless salt solution. An admirable method to introduce salt solution into the blood is the Murphy or stillicidium method, in which, through a catheter carried high up into the rectum, the fluid is allowed to enter little more than drop by drop, when it is commonly absorbed as rapidly as it enters the rectum.

The convulsions themselves are best controlled by chloroform and chloral, the former being given by inhalation just sufficient to control the fits, while the latter, given by enema, produces a more permanent effect. I do not hesitate to give a dram of chloral at a single injection. There is at first a disposition to expel it, which may be controlled by compressing the buttocks for a few minutes.

CHRONIC NEPHRITIS.

While there may be minute differences in the structural changes which constitute different cases of acute nephritis, there are none which necessitate a division of treatment. In chronic nephritis, on the other hand, this is not the case. There are at least two distinct varieties and a possible third from the anatomical standpoint, quite distinct enough to demand their separate consideration, while there are certain principles of treatment common to all. These varieties are termed chronic diffuse nephritis and chronic interstitial nephritis. A third is the amyloid kidney. The typical anatomical expression for chronic parenchymatous nephritis is the large white kidney. In it proliferative changes of the secreting parenchyma are conspicuous, but alongside of these is associated overgrown interstitial tissue. It is this excess of parenchymal involvement which has given rise to the most commonly employed of the synonyms for this chronic form, viz., chronic parenchymatous nephritis.

In interstitial nephritis, interstitial changes are most conspicuous, and the typical anatomical expression of this is the contracted kidney. Between these are many intermediate degrees, which approach each other until a point is reached at which it is difficult to separate them.

Chronic Parenchymatous Nephritis or Chronic Diffuse Nephritis.

—The majority of instances of chronic diffuse nephritis have been cases of acute nephritis which failed of cure and have passed over into the chronic form. Others arise *de novo* from various causes. It is this form of chronic nephritis which is characterized by proliferative excess of secreting structure distending the tubules, compressing the bloodvessels and producing an anemia of the organ, which is partly responsible for the white color of the *large white kidney*. This cellular material is capable of some degree of function which makes this form less dangerous than the interstitial variety and more amenable to treatment. As time elapses, this redundant secreting structure disintegrates in part and is replaced by connective tissue, whence the name *diffuse nephritis* also applied to this chronic form.

The indications are to restore the kidney to its normal state; to promote elimination, and thus protect the organism against the accumulation in the blood of toxic matters which are responsible for the dreaded uremia; and to unburden the tissues and serous cavities of the dropsical transudations, which embarrass function and lower vitality.

Unfortunately we possess no drugs which directly promote the "healing" of the kidney, and our efforts must consist for the most part in placing the patient under conditions most favorable to the operation of nature's cure. The task is more difficult than that in acute nephritis, but, as with it, rest is a fundamental condition, and although the milder grades may permit some activity and even attention to business, rest is the keynote of whatever success we may attain.

On the other hand, fresh air and outdoor life are as necessary, but in securing these, exposure to cold and especially cold and dampness, should be avoided. Warmth is proverbially helpful to cases of chronic nephritis, and cold is correspondingly harmful, suppressing elimination by the skin and introverting the surface blood into the internal organs, including the kidney. Hence, warm clothing and especially woollen underwear are essential for these patients, and should be worn in all seasons, adapting the weight to the season. I have known a simple chilling of the body, acquired while watching a baseball game, turn the tide from convalescence to a fatal issue.

An evident essential condition of recovery such as we are seeking is a normal nutrition which in turn depends on a right state of the blood. In chronic nephritis the blood tends to deteriorate by loss of albumin and accumulation of poisons eliminated by the healthy kidney. Hence result anemia and toxemia. The anemia is best combated by the preparations of iron, and unless set aside to give place temporarily to more urgent treatment, this remedy should be almost continuously administered. To this end the well-known Basham's mixture, the liquor ferri et ammonii acetatis of the *Pharmacopœia*, has been so frequently prescribed as almost to have acquired a reputation as a specific. This is a grave error, as it has led to its use when better omitted. It is, however, a good preparation where iron is indicated, and it is preferred by many because somewhat diuretic. It should be given freely, diluted in doses of 2 to 4 fluidrams three times a day. All of the preparations of iron are useful, but all tend to constipate, and this tendency must be combated. Another combination of iron also diuretic is a mixture of tincture of the chloride of iron and the spirit of nitrous ether. It is quite helpful and usual to reinforce any of the preparations of iron by strychnine and quinine salts in suitable doses. Bland's pill is always a good preparation, and a small quantity of aloin may be added to counteract the constipating tendency if it shows itself.

To combat the toxemia, eliminating measures are also necessary, and the bowels should be kept free, and the kidneys, which, as intimated, are still quite responsive to diuretics, should be gently stimulated. The official liquor potassii citratis and the liquor ammoniæ acetatis are such stimulants given in tablespoonful doses, although the more active

diuretics, including digitalis and strophanthus, may be given. A nightly warm bath or a Turkish bath, or an electric light bath, once or twice a week, are efficient agents in stimulating elimination by the skin.

Massage is a useful measure to equalize the circulation, on which so much depends, and where the patient cannot afford it some members of the family should be taught to do it. In my experience, it also increases the secretion of urine.

In the advanced stages of this disease we have the same symptoms of dropsy and uremia to combat as in severe cases of acute nephritis, and they are treated similarly. (See p. 685.) The reader is also referred to what is said on p. 686 on the subject of skin elimination.

The diet need not be so stringent as in acute nephritis or chronic interstitial nephritis, but should be plain and easily assimilable, while proteid foods should be restricted but need not be eliminated. Milk, bread and butter, the cereals, and all vegetables and fruits, especially cooked fruits, are allowable; also soft cheeses and milk preparations, to which cream and sugar may be added for deserts.

Chronic Interstitial Nephritis.—The kidney of chronic interstitial nephritis is an organ reduced in size in which there has been a more extensive destruction of the parenchyma of the organ and a corresponding replacing overgrowth of interstitial connective tissue. The older view, that the destruction of the parenchyma is the direct result of encroachment of connective tissue, has given place to that which supposes a primary very slow destruction of parenchyma and its substitution by connective tissue. The process differs from chronic diffuse nephritis in that in the latter there is first an overproduction of parenchymal cells, which subsequently die and are replaced in part by interstitial tissue, while in the contracted kidney there is destruction without previous proliferation, and a corresponding substitution of connective tissue.

It may be mentioned at this stage that chronic interstitial nephritis is a disease of those past middle life, being very rare in youth, and the majority of those affected are past forty. It is important to remember also that in old age there is a tendency to overgrowth and contraction of the connective tissue of the kidney as of other organs, whence the term *senile atrophy* or contraction of the kidney. This tendency also comes earlier to some than to others.

The contracted kidney is an organ whose function is embarrassed, resulting in diminished elimination, compensated to a degree by increased secretion the direct result of associated hypertrophy of the left ventricle.

The problem is again to devise methods to arrest the process and if possible to restore the normal structure of the organ, to protect the economy against the toxic effect of accumulated excreta, and to treat as they arise certain accidents and complications which threaten the patient.

The first is the most difficult to accomplish, but quickest disposed of. After many years' experience I am forced to the conclusion that we possess no power to remove the overgrown interstitial tissue or to restore the normal parenchyma by drugs directed to the kidney itself. Two remedies which under other circumstances do dissolve connective tissue are the

iodide of potassium and bichloride of mercury, and they have been used for this purpose in diseases of the kidney by many. Indeed, I still prescribe them in certain cases. The iodide has, at least, the property of dilating the arterioles and thus facilitating the circulation of the kidney, while the bichloride in small doses is also an antiseptic tonic. My method is to give the maximum dose which can be given without disturbing the stomach, of the iodide, say 5 gr. twice a day, and even less if there is the least evidence of its disagreeing. If easily borne, the dose may be increased but should never be large. If anything is to be gained by its use, it is through its long-continued administration, and this makes it difficult to judge of its efficiency, because the patient is apt to pass from under observation. The bichloride, I add, when there is albuminuric retinitis, beginning with $\frac{1}{24}$ gr. doses and continuing also indefinitely, though after a time I usually reduce the dose to $\frac{1}{40}$ gr., which I have continued for months and even years, increasing the dose from time to time for shorter periods. More frequently under these circumstances I have given the biniodide in the same doses. Many ophthalmologists also regard the biniodide as useful in this complication.

Sclerotic arteries which are so often associated with contracted kidney are favorably influenced by the iodides.

Granted that we have little or no power to restore the normal structure of the kidney, can we do anything to arrest the spread of the morbid state? I think we may. And this brings us, among other things, to the dietetic treatment of chronic interstitial nephritis. For studies in etiology have shown us that food and drink have much to do with its causation. We know that it is the office of the kidney to remove irritating and toxic substances from the blood, and that nephritis is often due to irritating effect of such substances on the parenchyma of the organ. It is plain, therefore, if such substances are restricted the chief cause of the disease is removed, and we may hope to arrest its extension by eliminating them from the diet. Proteid foods and alcohol are the chief offenders. Hence, it is usual to cut out or reduce meat and nitrogenous foods from the dietary. Proteids enter into the composition of other foods, including milk and cream, but not only is the quantity in them in smaller proportion, but it would appear that their proteid constituent is less harmful than that of lean meat. Vegetables and wheat flour also contain proteid, but the proportion is smaller. Fruits and fruit juices contain a minimum of proteid. Hence, a diet of milk, bread, vegetables, and fruit includes, in a word, the food for the victim of this disease. That such a diet is compatible with perfect physical health the vegetarians have shown over and over again, and to the majority of those who want to live it is generally acceptable. How far digressions may be permitted in cases of moderate severity must be left to the judgment of the physician. On the other hand, a necessary increased stringency may be helped by the omission of vegetables containing a large proportion of proteid, such as beans. Under such a rigid diet I have known subjects of chronic interstitial nephritis to continue in fair health for many years.

I have referred to fruits. They are an ideal food in interstitial nephritis;

indeed, in all forms of nephritis when allowed in reasonable quantity. Due regard must be paid to the fact that cooked fruit is easier of digestion than raw fruit.

Alcohol is often a cause of interstitial nephritis, while overeating and alcohol ingestion combined are a more frequent cause than either alone. Hence, alcoholic beverages, especially those with high alcohol percentage, such as brandy, whisky, gin, and heavy wines, like sherry, port, and champagne, should be disallowed. The light wines, including clarets and sauternes, may be allowed in moderate quantity, say a wineglass or two at dinner. Tobacco in excess is extremely harmful through the nicotine which it contains, producing marked contraction of the bloodvessels and rise of blood pressure.

Starches and sugars are not contraindicated in interstitial nephritis. Indeed, they form an admirable food, giving heat, force, and strength without developing waste toxic products. Fats in the shape of butter and cream are admitted in moderate quantities. Dietetic restriction is much more important in chronic interstitial than in chronic diffuse nephritis, since in the latter disease excretion is more complete and the danger of toxic accumulation is correspondingly less.

Spices and condiments such as mustard, pepper, and horseradish are to be rigidly excluded on account of their irritating character. Cantharides, if prescribed as a medicine for any purpose, should be cautiously used.

Finally, digestion is often deranged in this form of chronic Bright's disease, and is treated as the same condition elsewhere. Pepsin, hydrochloric acid, and tincture of nux vomica are efficient, and sometimes minute doses of bichloride of mercury are useful.

The matter of clothing is important. It should be of wool next to the skin at all seasons, suited in weight to the temperature. It is especially with a view to favoring the action of the skin on the one hand, and on the other of preventing suppression of such action by a sudden chilling of the surface, that such clothing is serviceable.

To the same end is warm bathing. The patient should take a warm bath on retiring every other night, or every night if it be convenient, while an occasional Turkish bath is still even more helpful to avert complications and preserve the integrity of the kidney. The reader is again referred to the office of the skin in elimination on page 686.

It is therefore evident that warmth, warm weather, and warm climates are favorable surroundings of the patient with interstitial nephritis, and this has also been frequently illustrated by the fate of patients afflicted with this disease passing from warm to cold climates, who have perished from the aggravation of symptoms incident to such changes largely ascribable to repressed elimination. Hence, too, prolonged cold bathing in salt or fresh water is strongly contraindicated. I think I have seen fatal uremia excited by such practice. On the other hand, a momentary cold plunge, especially if followed by a prompt reaction, may be a wholesome tonic, favorably influencing elimination.

Are drugs of any use? Not much. I have already discussed the efficiency of the iodides and bichloride of mercury. As to others, they are

indicated mainly to meet symptoms. Anemia is one of these symptoms, but it is by no means an invariable one. It is in chronic interstitial nephritis that the chalybeates have been overused, especially Basham's mixture, the solution of the acetate of iron. It often does more harm than good in locking up secretion and causing headache. Iron should therefore be reserved for an associated anemia.

There is not generally any falling off in the twenty-four hours' urine. Indeed, it is commonly increased because of the more powerful action of the hypertrophied left ventricle. The solids, on the other hand, are abnormally low. The elimination of solids is slightly increased by stimulating the flow of urine, but toxic excretion is better stimulated by acting on the skin and bowels. Toward a fatal termination the urine becomes more scanty, uremia sets in, and the case often terminates with anuria.

The hypertrophy of the left ventricle itself may require treatment, as may also the high tension characteristic of this disease and partly due to the hypertrophy. It shows itself in a pounding or thumping sensation in the head or over the entire body, or by a high tension which can only be accurately measured by the sphygmomanometer. The blood pressure in cases of chronic interstitial nephritis often reaches 250 millimeters and even more. This is a dangerous degree, and should be promptly met by treatment. The nitrites are the usual remedies, and of these, especially glonoin or nitroglycerin. It should be commenced at once in $\frac{1}{100}$ gr. doses every two hours, or in larger doses if it does not produce the desired result. The nitrite of sodium may be given in 3 gr. doses, and is said to have a more permanent effect, but it has not proved satisfactory in my hands. Dr. William H. Thomson, of New York, has called attention to the tincture of aconite as a more efficient drug for this purpose. He recommends $2\frac{1}{2}$ minims, or 5 drops, every three hours, kept up for some time. I have known it to reduce blood pressure when nitroglycerin failed to do so, but I do not think it should be long administered in the dose named.

The treatment of uremia, a frequent complication of this form, occurring also often when least expected, was fully considered when treating of chronic parenchymatous nephritis. Prophylactic treatment is very important. In fact, the entire treatment, as just discussed, has for its object largely the prophylaxis of uremia. It will be remembered that diet, clothing, climate and temperature, bathing, exercise, elimination by the skin, kidneys, and bowels were all considered with a view to their effect in eliminating toxic agents from the blood either by limiting their ingestion or stimulating their excretion. I desire to revert again to the eliminating advantages of purgation. Von Noorden considers it even more efficient than skin elimination, a dictum which I once heard him emphasize in the following language: "Given a case of nephritis with diarrhea, be in no haste to cure the diarrhea."

AMYLOID DISEASE OF THE KIDNEY.

The comparative rarity with which this condition is recognized as a separate state may justify its definition here as an infiltration more or less complete of the substance of the kidney with a peculiar proteid substance known as amyloid, albuminoid, or lardaceous material, resembling molten wax or boiled starch, and recognized by its striking a mahogany-red color instead of yellow with solution of iodine, although a beautiful pink with it appears to occur in suppurating and other exhausting diseases like tuberculosis syphilis, and joint disease. The symptoms are often identical with those of chronic parenchymatous nephritis, while the etiology is very different. Nor can it be regarded, strictly speaking, as a variety of nephritis. It is even doubtful whether Bright included it among the diseases studied by him and bearing his name. The conditions are, however, often associated; that is, the kidney of chronic nephritis becomes affected in places with amyloid infiltration.

Fortunately its treatment is similar to that of chronic parenchymatous nephritis. Most important is prophylaxis, that is, syphilis, tuberculosis, and bone diseases must be promptly and searchingly dealt with, while the possibility of amyloid kidney arising under the circumstances must always be remembered. Prompt removal of diseased bone and early recognition of syphilis and its proper management will avert many a case. Hence, frequent examination of the urine in these diseases is important, with a view to catching the first moment of invasion.

Is it possible ever to cure an amyloid kidney? To restore its normal state? Since the condition appears so directly the result of deteriorated blood, definitely caused, it would not seem unreasonable that minor degrees should disappear with the removal of the cause aided by further treatment, especially in the young, who are most often afflicted.

The question of the eradicability of syphilis itself is closely associated with the prevention of amyloid disease, and he is a safe adviser who acts on the dictum of the older syphilographers that a case should be treated continuously by mercurials in small doses for not less than two and one-half years, or for at least six months after the disappearance of the clearly syphilitic symptoms. The mercurial indicated would be the biniodide and the doses $\frac{1}{50}$ to $\frac{1}{20}$ of a grain, and it is not amiss to continue the iodide of potassium for six months longer. On the other hand, it must not be forgotten that excessive mercurialism is productive of degenerative changes which invade the kidney as well as other tissues, and treatment must be based on accurate diagnosis and trained judgment. There would seem to be less amyloid disease in the last thirty years, which may be reasonably ascribed to the more modern management of tuberculosis in its various forms and as well probably of syphilis.

It goes without saying that the patient with amyloid disease should be nourished with the best of food, including animal flesh, broths, milk, good wine, rational hygiene, by bathing, massage, fresh air, and tonics containing the salts of iron, calcium, and magnesium, which the sup-

purating diseases referred to destroy. Such tonics are the phosphates from the animal and vegetable kingdom combined with strychnine or nux vomica. Under the circumstances it would seem that the iodide of iron would be a very suitable form of iron, and the iodides in other combinations useful.

As I am finishing this section, the journals are teeming with reports of the arsenic treatment of syphilis-preparation "606" of Ehrlich. Doubtless the writers cast for this subject will fully present it.

Serum Treatment of Bright's Disease.—Several attempts have been made to apply organotherapy to the treatment of Bright's disease, but the results have not been encouraging up to the present time. It is founded upon the original announcement of Claude Bernard that the internal secretion of glands is contained in the blood which passes from them, that is, in the blood of the vein. The treatment consists in the subcutaneous injection of serum from the renal vein of a goat. Analogous methods have been the use of a kidney extract by Professor Dieulafoy and others, and small pieces of pig's kidney by Professor Renault. That to be considered was first suggested by Vitzou, of Bucharest, and applied by Turbure at the Pantelimon Hospital in that city. Turbure published, as early as 1896, a remarkable case of interstitial nephritis in which uremic symptoms supervened after five years, and were dissipated after six injections of 15 c.c. each of defibrinated blood from the renal vein of a dog. Later, the blood of the goat was substituted. The serum is obtained by aspirations of the renal vein, through an opening in the abdominal wall, due antiseptic precautions being observed. The vein is first ligated at its junction with the cava, with a view to securing the maximum of unadmixed internal secretion. The serum is separated in the usual way and sealed in ampullæ for use.

The clinical application thus far has been made chiefly by Professor J. Teissier, of Paris, and his pupils, with results sufficiently satisfactory to justify reference to it, although I have had no experience with it myself.¹

The treatment is said to be harmless and applicable to any case of Bright's disease, acute or chronic, including puerperal nephritis, but a satisfactory result is the more likely the more acute the symptoms, be they those of acute nephritis or those of arrest of function in sound portions of parenchyma of a chronically diseased organ. It is not claimed that it restores the normal structure. Its effect is to promote diuresis and to remove more or less completely all unfavorable symptoms, including albuminuria, dropsy, uremia, dyspnea, Cheyne-Stokes breathing, etc. It is said to diminish the toxic qualities of the urine while it increases the urea eliminated. According to Teissier the effect is more favorable and more rapid the more the disease picture is associated with signs of liver inadequacy. In puerperal nephritis its

¹ For further details the reader is referred to the paper of Prof. Teissier, "Serum Therapie der Nephritides," in *Klinische Therapeutische Wochenschrift*, No. 44, Wien, November 2, 1908.

effect is said to be not only to cure the eclamptic attacks when present, but also to prevent their occurrence.

The usual dose of the sterilized serum is 15 c.c. injected into the subcutaneous tissue of the abdominal walls daily until the desired effect is secured. Striking results may follow one or two doses.

The rationale of the treatment can only be a matter of conjecture, and is probably several fold. It may be in a measure antitoxic, or it may have a stimulating effect on the function of the renal cells or the glomeruli, supplying, in a word, all the effects of the internal secretion which the diseased kidney has lost the power to produce.

Some would even recommend extracts prepared by macerating the kidneys of pigs, and claim that albumin and casts diminish under their use. Among these are Carnot, Renaut, Teissier, Dubois, Lorand, and others, especially French physicians.

SUPPURATIVE NEPHRITIS.

This form of nephritis, the result of infection by some of the pus-producing organisms, and often called the *surgical kidney*, is amenable for the most part only to surgical treatment, and excellent results have been thus obtained when the suppurative process has not gone too far. Medical treatment can be but palliative, and consists in the administration of antiseptics and tonics. The most efficient of the former is urotropin or cystogen, of which the active constituent is formaldehyde. It is given in doses of 3 to 10 grains three or four times a day. My usual practice is to give 5 grains between meals and at bedtime, so that four doses a day are taken. Mild grades are favorably influenced and mild catarrhal processes of the pelvis of the kidney are even cured. In severer grades the normal acid reaction of the urine is restored and the tendency to decomposition is removed, rendering the urine less irritating. Other drugs for the same purpose are salol, benzoic acid, and sandalwood oil. Salol is given in the same doses and same manner as urotropin. Benzoic acid may also be given in 5 grain capsules four times a day. The dose may be somewhat increased. Sandalwood oil is best given in soft gelatin capsules containing 10 minims, of which also 4 are given daily. It, too, may be increased, but these last two medicines tax the stomach rather severely. Methylene blue is also an excellent remedy in catarrhal inflammations invading the kidney. It may be given in 3 grain doses in a capsule, but the color imparted to the urine and thence to the linen of the patient makes it objectionable. Pain which is often severe must be relieved by opiates, best administered hypodermically. The tendency of these diseases to weaken the patient demands the associated use of tonics like strychnine, quinine, nux vomica, and iron.

Medical treatment should not be long persisted in if not successful, and time is saved by a prompt surgical operation, especially if there be stone in the kidney or tuberculosis of that organ. The x-rays are often an aid to diagnosis in these cases.

The Operative Treatment of Chronic Bright's Disease.—Decapsulation holds a place in the treatment of chronic Bright's disease which has not been sufficiently acknowledged, largely because of the apathy of surgeons and the timidity of physicians. That the operation may have been done unnecessarily at times by its originator, the late George M. Edebohls, and his pupils is true. Nevertheless that there are conditions in which it is serviceable in prolonging life, I am satisfied from my own experience, having had it done a number of times with much advantage to my patients, one of whom, a girl, is living and doing light work six years after operation. On the other hand, I have never known it to produce a cure, and I have more than once disadvised it.

The mode in which Edebohls hit upon it is sufficiently interesting to justify its repetition here. He observed that the anchoring of the kidney in certain cases of the floating organ in which there was also chronic Bright's disease was attended with benefit to the patient. At first he ascribed this to correcting the mobility of the kidney, and it was not until after three secondary operations on kidneys which had been anchored some time previously that he discovered the essential condition underlying the cure to be decapsulation or decortication, which consists in stripping off the capsule and cutting it away entirely close to its junction with the pelvis of the kidney. His first report was made in the *Medical News*, April 22, 1899. The success of the operation depends, according to Edebohls, upon arterial hyperemization of the kidney, whereby an increased and adequate blood supply is furnished the organ, permitting absorption of interstitial and intertubular inflammatory products and relieving the tubules and glomeruli from the pressure which interferes with function.

The conditions under which I advise operation are the persistence of albuminuria and dropsy after all other treatment has had a fair trial. The operation is commonly promptly followed by increased secretion and rapid disappearance of dropsy, with large and often rapid reduction in the amount of albumin. At other times the albuminuria diminishes more slowly. I cannot say that I have ever known the albuminuria to have disappeared entirely, or, as I have said, the disease to be entirely cured. It should be stated that by experiment on animals it has been found that after a time the capsule is reproduced. This may account for the failure of permanent cure.

In his latest paper, read shortly before his death before the American Medical Association in June, 1908, Edebohls claimed that out of 102 operations 33 were complete cures, 48 were followed by improvement, and 21 experienced no benefit whatever.

Albuminuric Retinitis.—Something has already been said of the treatment of albuminuric retinitis on page 690, but in a matter so important, it seems worth while to collect what there may be under a separate heading. The structural changes in the retina which are gradual in their invasion, as contrasted with those of uremic amaurosis, are of a kind one would naturally expect to be slow of removal at best, and it is true that a retina thus scarred never resumes its normal structure.

Nevertheless, changes for the better do occur, even spontaneously, consisting in partial absorption of hemorrhagic spots. That these and other changes may be favored by treatment seems, therefore, reasonable. The drugs which have acquired some reputation are chiefly the mercurials and iodine including the bichloride of mercury and iodide of potassium and the biniodide of mercury. The latter is given in doses of from $\frac{1}{50}$ to $\frac{1}{25}$ gram three times a day, kept up for a long time without interruption, care being taken to avoid gastric derangement. The bichloride is given in the same doses, and the iodides in 5 to 10 grain doses. Large doses of the iodides are not advised. Iron is also useful, as these causes are generally anemic. On the whole I prefer Blaud's pill mass of iron sulphate in 3 to 5 grain doses, although tincture of the chloride and Basham's mixture are convenient forms. Where there is high tension, the nitrites and even aconite are indicated to reduce it, as it predisposes to rupture and retinal hemorrhage.

ALBUMINURIA.

There is no treatment of albuminuria beyond the treatment of the disease of which it is a symptom; that is, there is no treatment comparable to that of the checking of hemorrhage by a styptic. Where albuminuria is due to Bright's disease, its treatment is that of the variety of the disease which causes it; when it is due to pus its treatment is that of the pyuria causing it, and when it is due to hemorrhage into the urinary passages its treatment is that of such hemorrhage. Lymphorrhagia and chyluria are also accompanied by a certain amount of albuminuria, because albumin is a constituent of lymph and chyle.

I believe I have tried almost all of the remedies which have been brought forward in the last forty years as reputed direct cures for albuminuria, and have found all useless. Now and then from some temporary cause the remedy would seem to have been effective, but in a short time the illusion has always been dispelled.

It is true there are certain drugs and even foods which increase albuminuria, and may even produce it *de novo*, the withdrawal of which is followed by a diminution or disappearance of the albumin. Thus, cantharides, mustard, horseradish, and even rhubarb in large quantities may produce a renal albuminuria, and while I have never known egg albumen in any quantity to cause it in healthy kidneys, I do know that, given an existing renal albuminuria, it may be increased by the addition of egg albumen to the food. Again, it is well known that a meat diet will increase the albumin in a urine, while its withdrawal will reduce it; also, that, given a renal albuminuria, a pure milk diet will reduce the albumin. So will rest, while activity will increase it or bring it on when absent in certain cases, as is shown in the so-called albuminuria of adolescence, which may be influenced in the manner described by any of the last-named agencies. It would therefore not be profitable to discuss any further the treatment of albuminuria.

Albuminuria of Adolescence.—This interesting condition consisting in an albuminuria which affects boys and girls between the ages of fourteen and twenty is further characterized by the small amount of albumin present, say, no more than $\frac{1}{10}$ volume of the urine tested, by complete absence of albuminuria during rest and increase during activity, and by the absence of edema and other symptoms of Bright's disease, except perhaps tube casts. These may be occasionally present, just as they may occasionally be found in normal urine after centrifugation, so that their significance must be measured by associated conditions. Thus, if the boy or girl has just had an attack of some infectious disease, the presence of casts would be significant and should be carefully weighed in making the diagnosis. Whether the presence of albumin in boys or girls of this age without other symptoms is due in any way to sexual development, I do not know. Certain it is that under the circumstances, the bloodvessels of the kidney leak out albumin more readily than in strictly normal organs.

It is further characteristic of such albuminuria that it disappears without active treatment chiefly at the age of eighteen to twenty. The indications for treatment may be inferred from what has been said. It is evident that an overactive life, such as is involved in strenuous athletic games, like football, cycling, and tennis, must be avoided. On the other hand, fresh air and outdoor life are indicated. Long restful nights are also necessary to these children, and late hours are harmful, while dancing adds to the danger. Chilling the body by draughts of cool air or submersion of the body for a long time in cold water is harmful. To avert such effects the wearing of woollen underclothing in summer and winter is important. The diet should be largely of milk and vegetables, although a little meat daily may be allowed. In these cases even eggs are to be cautiously permitted. I have known them to increase albuminuria in an albuminuric boy. Their effect should be tested. The free use of water is indicated, but bloodvessels should not be surcharged lest blood pressure be too much increased. Medicines are not indicated except to meet symptoms. The bowels should be kept regular, and not unless there be anemia is iron indicated. Frequent warm baths are indicated to keep the skin acting and to maintain elimination, thus preventing the accumulation of toxic substances in the blood. Special pains should be taken to protect these children from contagious diseases, because their kidneys are very susceptible to irritation, and the tendency to nephritis is greater in them than in others.

CHYLURIA.

Chyluria is a condition of urine due to the admixture of chyle, commonly in such quantity as to give the urine a more or less milky appearance, the fat being present in a minute state of subdivision. It is due to a leakage of the chyle into the urinary tract in some part of its course, the degree of coloration depending on the quantity of lymph admixed. Such leakage

is undoubtedly due in some cases and possibly in all to a plugging of the lymph channels by the prematurely discharged ova or embryo worms of the adult *Filaria sanguinis hominis* (*Filaria bancrofti*), whence the name *Chyluria parasitica*. In these cases the embryos (the *f. s. h. nocturna*) are found floating in the blood, while the parent forms are found in groups in the lymphatic trunk and may aid in forming the obstruction which causes rupture and leakage. In other instances the most searching examination has failed to find any such obstruction, whence the name *Chyluria non-parasitica* or idiopathic chyluria. In operations for lymphoscrotum the leakage chyle vessel has been found pouring its contents into the tunica.

No remedy or operation has been devised to correct this condition, which is, however, a harmless one, and after persisting sometimes for years, disappears spontaneously. Since it has been ascertained that the filaria is disseminated by a species of mosquito (the *Culex fatigans*), as is the case with malaria and yellow fever, precautions against infection by this insect will doubtless be taken which will ultimately result in the stamping out of the disease.

LITHURIA.

Lithuria is a condition of the urine in which it is surcharged with uric acid and its compounds. Uric acid is frequently found pure in the urine in the shape of rhombic crystals relatively insoluble and often so large that they are visible to the naked eye, but most of the uric acid exists in combination with sodium, potassium, and ammonium, forming biurates which are relatively insoluble and therefore prone to form sediments. These sediments of uric acid and urates are the sources of much mischief, producing irritation of the urinary passages and forming larger aggregations constituting gravel and stone. The condition thus produced is further intensified by the fact that in lithuric cases the urine is usually reduced in quantity.

The treatment of this condition is first by alkalies and diluents. The former unites with the excess of uric acid and forms soluble urates. The solution of these is further favored by the free ingestion of water. The same object may be accomplished by the use of the natural alkaline mineral waters, as those of Vichy, Ems, and Neuenahr. Of these, a quart or more should be drunk daily. Thus the solution of the urates is favored. We have unfortunately no alkaline mineral waters in the United States comparable to those mentioned.

In lieu of the alkaline mineral waters, and in addition to them, the alkalies usually prescribed are the citrates, carbonates, and acetates of potassium and sodium. They should be given in full doses of 15 to 20 grains freely diluted every two or three hours for an immediate effect, and two to four times daily where a prolonged but less active effect is desired.

But it is not enough to give alkalies. We should also coöperate by holding back the foods which contribute uric acid to the blood. These

are the proteids, and especially meats and eggs. These should be totally or partially withheld according to the urgency of the symptoms.

The chemistry of uric acid, always complex, has become so much more so that it seems necessary to touch on it briefly, the better to understand its therapeutics. The latest views ascribe uric acid to the decomposition of certain albumins known as nucleins, and of the nucleins only the nuclear nucleins, that is, those containing a nucleinic acid radicle. On the other hand, the paranucleins which do not contain this radicle, do not produce uric acid. There are four nucleinic acids, viz., adenylic, guanylic, sarcocyclic, and xanthilic, each of which contains a base, adenin, guanin, sarcine, and xanthin, respectively. These bases are called purin bases,¹ because derived from a hypothetical compound called purin. Uric acid is increased in the urine after the ingestion of all substances which contain purin bases as such or combined as nuclear nucleins. Such substances are thymus gland, liver, kidney, and brain, but, generally speaking, animal foods are followed by a larger uric acid output than vegetable food. So we come back to the original proposition, whether the uric acid comes from the nucleins ingested, or whether it arises from the nucleins in the leukocytes of the body tissues, as claimed by Hombaczewski and others who regard the leukocytes as the chief source of uric acid, and the foodstuffs as acting only as a stimulant to cell formation and cell destruction.

Other facts to be remembered are that a certain amount of uric acid is converted into urea in the body and that some uric acid may be formed synthetically as it is in birds and reptiles; that some is consumed in the normal oxidations of the body and that some is eliminated in the feces; that finally, uric acid is formed in all the organs and tissues of the body.

A fallacy has crept into the minds of the laity, and I am sorry to say also of some physicians, to the effect that while the red meats are uric acid producers this is not the case with white meats, as those of chicken, veal, and fish, so that patients have come to me with the belief that while eating chicken, even liberally, they are not eating meat. In point of fact, there is little or no practical difference between white meat and red meat. Both are nearly pure proteids, and the little excess of red blood in the red meats scarcely influence its composition. It is, therefore, the quantity of meat and not its kind which must be considered and reduced to a minimum or cut out completely. Lithuria is thus neutralized with comparative facility.

OXALURIA.

A condition of deranged metabolism, in which the urine is continuously charged with crystals of oxalate of lime, including octohedra and dumb-bell varieties, which form a flocculent sediment or be deposited on the sides of the vessel, and capable of uniting into microscopic or larger calculi, which may intensely irritate the urinary passages. A small amount of oxalate of lime may be in the urine without producing symp-

¹ Also called xanthin bases and alloxur bases.

toms, and therefore may be regarded as normal. This is probably introduced from without in the vegetable food, of which rhubarb is one of the richest sources. Certain it is that one can easily produce oxalate of lime in one's own urine within an hour after taking a dish of stewed rhubarb, examination of such urine disclosing immense numbers of crystals.

It is conceded also that oxalate of lime can be formed within the body either in the blood or at the moment of secretion in the kidney. It is probably that abnormalities in this formation represent a part of the deranged metabolism resulting in an abnormal oxaluria. Two other sources of oxalic acid probably exist. One of these is the nuclein which has been already discussed, which represents an antecedent state of oxalic acid as it does of uric acid. Uric acid is readily oxidized into oxalic acid with parabamic acid and oxaluric as intermediates, and an increase of uric acid elimination is commonly associated with an increase of oxalic acid. Connective tissue and gelatin when ingested in large amounts likewise increase the formation and discharge of oxalic acid, probably because they stimulate the formation of nucleins.

Another source of oxalic acid is said to be excessive fermentation of ingested carbohydrates in the intestines, associated with gastritis and the absence of hydrochloric acid from the gastric contents. This has been artificially accomplished by the prolonged feeding of dogs with an abundance of meat. The usual manifestation of an abnormal oxaluria is the pain it excites in the urinary tract, associated often with hematuria and albuminuria, and even the presence of tube casts.

The treatment of oxaluria may be inferred from the above, consisting, first, in the elimination from the food of substances rich in oxalic acid, including tomatoes, carrots, celery, string-beans, rhubarb, potato, dried figs, plums, strawberries, cocoa, tea, coffee, and pepper; also substances which stimulate the formation of nucleins.

Foods which contain little or no oxalic acid are meat, milk, eggs, butter, cornmeal, rice, peas, asparagus, cucumbers, mushrooms, onions, lettuce, cauliflower, pears, peaches, grapes, melons, wheat, rye, and oat flour.

Since uric acid is readily oxidized into oxalic acid, it is necessary also to avoid the ingestion of all substances which contain purin bases and nuclear nucleins. Such substances are animal foods in general, but especially thymus gland, liver, kidneys, and brain.

There are certain persons in whom oxalic acid is constantly present in urine in the form of octohedral crystals of oxalate of lime, which can be made to disappear only on a milk diet. This condition is not commonly associated with evident symptoms and is further characterized by the minuteness of the crystals. This can hardly be regarded as a pathological state. There was at one time thought to be a more distinctive form of oxaluria known as the oxalic diathesis, or *oxaluria idiopathica*, pointed out by Bence Jones many years ago, with which were associated derangements of digestion and of the nervous system, and especially a depression of spirits. Later studies have shown that it is improbable that the oxaluria is in any way causal, but rather that both it and the nervous symptoms are a result of a deranged assimilation, the sum

of whose effects constitutes one of the combinations included today under the term neurasthenia. The association of such oxaluria with lithuria and a like train of symptoms occurring also in liberal eaters has led to the suggestion that oxaluria is only another one of the symptoms of the condition that the late J. M. Da Costa has so well described under the title of lithemia.

For such direct solution of oxalic acid like that produced by alkalies on uric acid we have no drugs, although clinicians have fallen into the way of giving much the same medicinal treatment for oxaluria as for lithuria, including alkalies. In those cases of intestinal fermentation alluded to in which oxaluria is a symptom and there is probably oxalic acid in the digestive tract but no free hydrochloric acid in the gastric contents, such treatment would not be called for. Hydrochloric acid in full doses in combination with a bitter is more likely to be serviceable.

In those large accumulations of oxalate of lime ending in oxalate calculus we have been able to find nothing more effectual than the measures mentioned, dietetic and medicinal with free ingestion of alkaline liquids or the alkaline mineral waters of Vichy, Ems, and Neuenahr. Given calculous symptoms, the recognition of oxalate of lime in the urine is pretty conclusive evidence that the stone is thus composed. On the other hand, there may be a pure oxalate of lime calculus in the kidney, while the urine passed at the time is entirely free from sediment.

It is evident that our knowledge of the processes resulting in increased elimination of oxalic acid by the kidneys is still very defective. Among the conditions illustrating this observation are those isolated cases of disease attended at times with large elimination of oxalate of lime. Such is diabetes mellitus in which there is for some reason at times very abundant excretion of oxalate of lime. The same is occasionally true of pneumonia and leukemia.

It is important, in dealing with the subject of oxaluric sediments, to remember that a moderate amount of oxalate of lime may be present in a urine which is altogether unattended by other symptoms; also that oxaluria and lithuria are probably a part of one and the same process of deranged metabolism.

PHOSPHATURIA AND PHOSPHATIC DIABETES.

Phosphaturia is a term which would naturally be applied to a condition of the urine in which more than the normal amount of phosphates are present. In view of the fact, however, that there is another condition very common and usually harmless, in which there is a precipitation of phosphates from alkaline urine, we somewhat arbitrarily call the former phosphatic diabetes, and the latter phosphaturia. Such tendency to precipitation it is well known is increased by the ammoniacal fermentation, and is further favored by the application of heat.

Under the teaching of Bence Jones, whose views prevail in England to the present day, it is there generally accepted (1) that phosphaturia in which calcium phosphate *only* is precipitated, depends on the presence

of a *fixed* alkali, and means nothing more than some derangement of digestion in which the alkaline tide of the urine becomes exaggerated; (2) that phosphaturia, in which *both* earthy and alkaline phosphates are precipitated, is caused by *volatile* alkalies; (3) that the excretion of phosphates, even if in excess, has no special pathological significance, such excess being mainly a measure of the ingestion of phosphates in the food.

In Germany more importance has been attached to the excretion of phosphoric acid in the shape of phosphates. While observers there admit the facts connected with the deposition of phosphates from urine alkaline by fixed and volatile alkali, they claim that the daily variation in the amount of phosphoric acid, especially as regards its relationship to the excretion of urea, has an important bearing on questions connected with tissue metabolism normal and abnormal. They claim that Bence Jones erred in saying that no excessive elimination takes place in chronic nervous diseases, and hold that it is in these diseases especially that the greatest elimination has been found, particularly in depressed states. They hold also that the absence of an absolute increase in the excretion of phosphoric acid does not disprove an increased elimination of phosphorus bodies, since in many nervous diseases phosphorus appears in the urine not fully oxidized, viz., as phosphoric acid, lecithin, or as glycerophosphoric acid.

In France, Professor J. Teissier, of Lyons, has described a condition he calls "phosphatic diabetes," consisting in the continuous and excessive discharge of phosphates in the urine, attended with symptoms not unlike those of saccharine diabetes. Of the cases of this condition Professor Teissier makes four groups: (1) Certain functional derangements of the nervous system; (2) those preceding or accompanying certain pulmonary diseases; (3) cases co-existing with glycosuria or alternating with it; (4) cases running a distinct course of themselves.

Finally, Charles Henry Ralfe, of England, has described 13 cases like those of Teissier, meeting all the essential conditions of the latter observer, admitting to his series no case in which the excretion did not exceed two-thirds the average normal excretion. Ralfe does not, however, accept the German view that the excess of phosphates is due to a breaking down of nervous tissue, but ascribes it to deranged nutrition. In the cases associated with glycosuria he considers the excessive elimination of phosphoric acid due to an abnormal formation of acid in the body.

The *treatment of phosphaturia* requires nothing but acid tonics, bitters, and digestives in which hydrochloric or nitromuriatic acid, tincture of nux vomica, compound infusion of gentian and pepsin may be combined in various proportions suited to the age and other conditions.

Phosphatic diabetes can only be recognized by a careful volumetric analysis of the phosphates, which must exceed the normal average of 2.5 grams. Teissier has found 7 to 9 grams in the twenty-four hours, in addition to the other symptoms named. Its treatment is restorative and supporting, largely also hygienic and symptomatic, including good food, mineral acids, strychnine, and opiates when necessary. The rest cure is suited to many cases.

DISEASES OF THE UTERUS AND THE PELVIC ORGANS

By BROOKE M. ANSPACH, M.D.

PRINCIPLES AND ARMAMENTARIUM OF LOCAL TREATMENT.

Asepsis.—In carrying out the various non-operative plans of gynecological treatment, thorough cleanliness must be observed, but rigid asepsis is not required, except in the case of intra-uterine or intravesical and urethral applications.

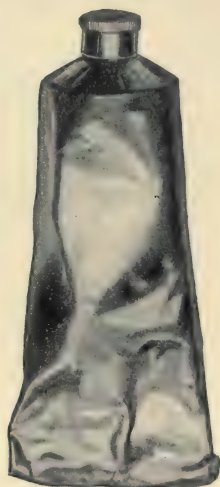
With the ordinary cleanliness there is little danger of infection; nevertheless, the possibility of transferring venereal lesions from one person to another must be kept in mind. Accordingly, after treating one patient, all the instruments which have been used should be scrubbed with soap and water, boiled for five minutes in 1 per cent. carbonate of soda solution, dried, and wrapped in a clean towel. If cleansed and protected in this way they may be used without further sterilization for the next patient.

Basins, pessaries, hard-rubber syringes, or apparatus of any sort injured by boiling may be sterilized by soaking in bichloride (1 to 1000), formalin (1 to 200), phenol (5 per cent.), or alcohol (70 per cent.) for fifteen minutes. Rubber gloves should be boiled in plain water for five minutes, dried, powdered, and placed in a covered jar or box. Special precaution should be observed after treating infected cases (gonorrhea, venereal warts, chancroid, chancre, and postpartum or postabortum infections), the duration of boiling and immersion in antiseptic solutions being doubled.

Cotton balls, tampons, gauze packing, etc., should be sterilized in an autoclave or in a portable Arnold or Rochester sterilizer. The sterilized articles should be stored in glass jars and protected from contamination.

Doctor's Hands.—Usually the ordinary soap-and-hot-water cleansing will do. When an infectious case has been treated the hands should be immersed in bichloride. For rectal treatment and the treatment of chancroid and syphilitic lesions the hands invariably should be encased in rubber gloves.

FIG. 29



Collapsible tube of lubricant.

Preparation of Patient.—It is a good plan for the patient to secure a movement of the bowels and to take a douche before coming to the office. The urine is passed immediately before treatment. Douching should be withheld from time to time in order to determine the effect of local applications upon leucorrhea, etc.

FIG. 30



Duck-bill (Sims') speculum.

FIG. 31



Bivalve speculum.

Position.—Ordinarily the dorsal position is used (Plate XV, Fig. 1). For the application of tampons in the treatment of retrodisplacement and for the inspection of the vaginal vault and the anterior vaginal wall, Sims' position (Plate XV, Fig. 2) and the knee-chest position (Plate XVI, Fig. 1) are of advantage.

Instruments.—Specula.—Two sizes of Sims' speculum (Fig. 30), a bivalve (Fig. 31) and a trivalve speculum (Fig. 32), are desirable. For

PLATE XV

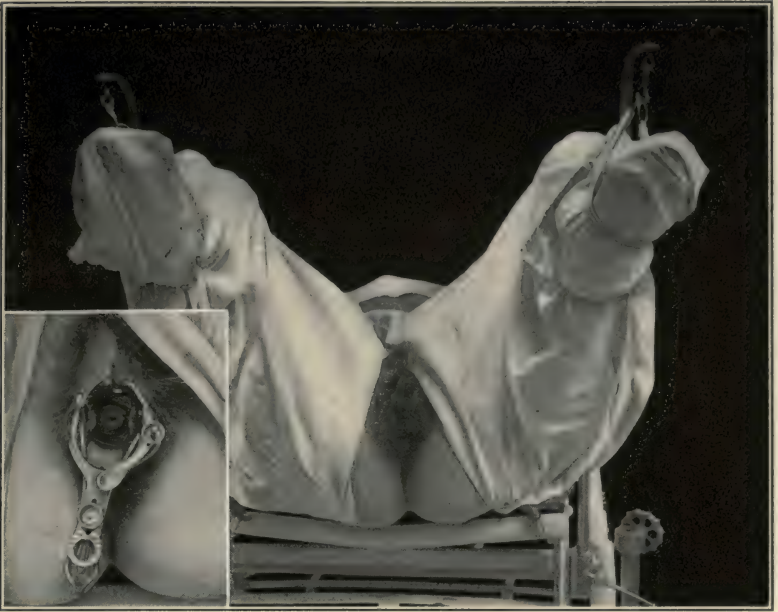


FIG. 1 (Dorsal Position).—The buttocks rest on the edge of the table and the legs are held by suspending the feet in stirrups. The knees are allowed to flex and the thighs rotate outward over the abdominal wall. If the greatest possible relaxation is not required, the legs may be supported by heel-rests at the end of the table. Enlarged section shows exposure of cervix and vaginal vault in this position, ready for applications to the cervix or the introduction of vaginal tampons.

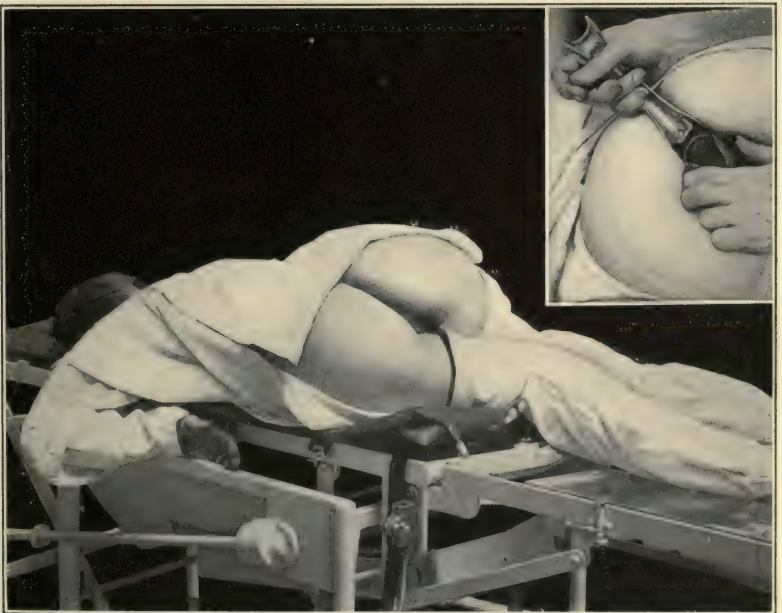


FIG. 2 (Sims' Position).—The patient is placed on the left side. The left arm hangs over the left edge of the table and the chest lies nearly flat upon the table, the patient's face being turned to the right. The legs are flexed on the thighs and the thighs on the pelvis at right angles. The right thigh is flexed more than the left and the right knee lies above the left knee, touching the surface of the table. The spine is rotated to the left. The hips may be further elevated by inserting a hard pillow beneath them. The position may be reversed (right-latero-prone). Enlarged section shows exposure of vaginal vault and cervix. The buttocks are held apart or elevated by an assistant. The posterior vaginal wall is strongly retracted with a speculum.

PLATE XVI

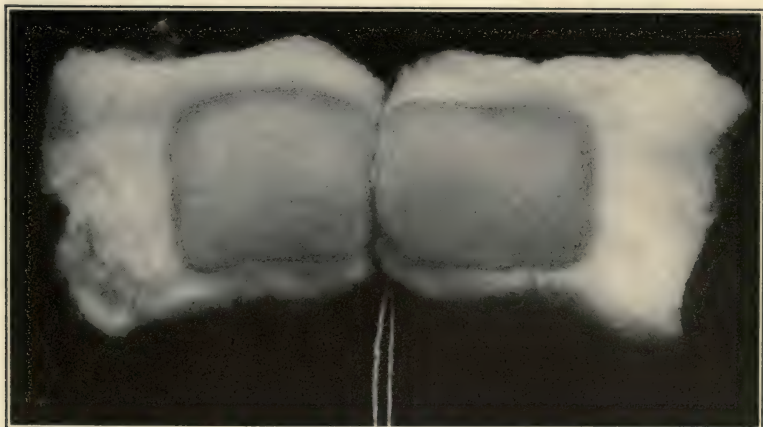
FIG. 1



Knee-chest Position.

The chest is close to the table. The spine is relaxed, the thighs are perpendicular, and the knees are close together.

FIG. 2



Vaginal Tampon.

The most satisfactory form of vaginal tampon is made of an inner layer of lambs' wool and an outer layer of cotton. The cotton wool gives it an elasticity which is not found in tampons made entirely of cotton.

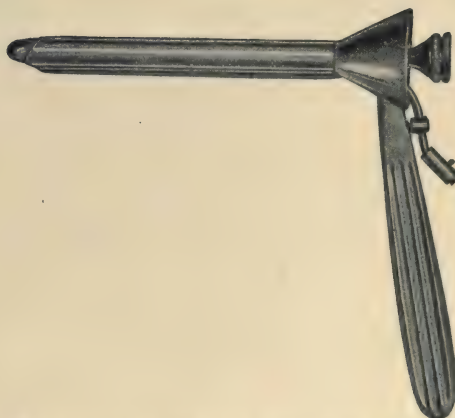
the visual examination of the cervix and vaginal vault in virginal women a large Kelly cystoscope, with attached or reflected light, may be used (Fig. 33). A speculum should be lubricated before introduction and inserted with its blade or blades in an oblique diameter of the vagina. It may then be turned into a transverse position. If the vaginal walls

FIG. 32



Trivalve speculum.

FIG. 33



Cystoscope of the Kelly pattern, with an electric lamp. Useful as a vaginal speculum for virginal women—the patient being in the knee-chest or the Sims position and the vagina distended by atmospheric pressure.

are redundant or the cervix is far back there may be slight difficulty in exposing the mouth of the uterus, but a little gentle manipulation of the speculum and pressure on the vaginal walls with a cotton ball held in a dressing forceps usually are successful (Figs. 34 and 35).

Applicators.—Toothpicks may be used, held in the jaws of a forceps or an adjustable handle. The ordinary nasal applicator serves the

purpose very well, except in the very unusual instances, where intra-uterine treatment is indicated. A larger applicator is then required (Fig. 36).

FIG. 34



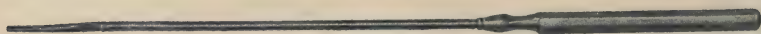
Proctoscopic speculum, with an electric light.

FIG. 35



Small bivalve rectal speculum.

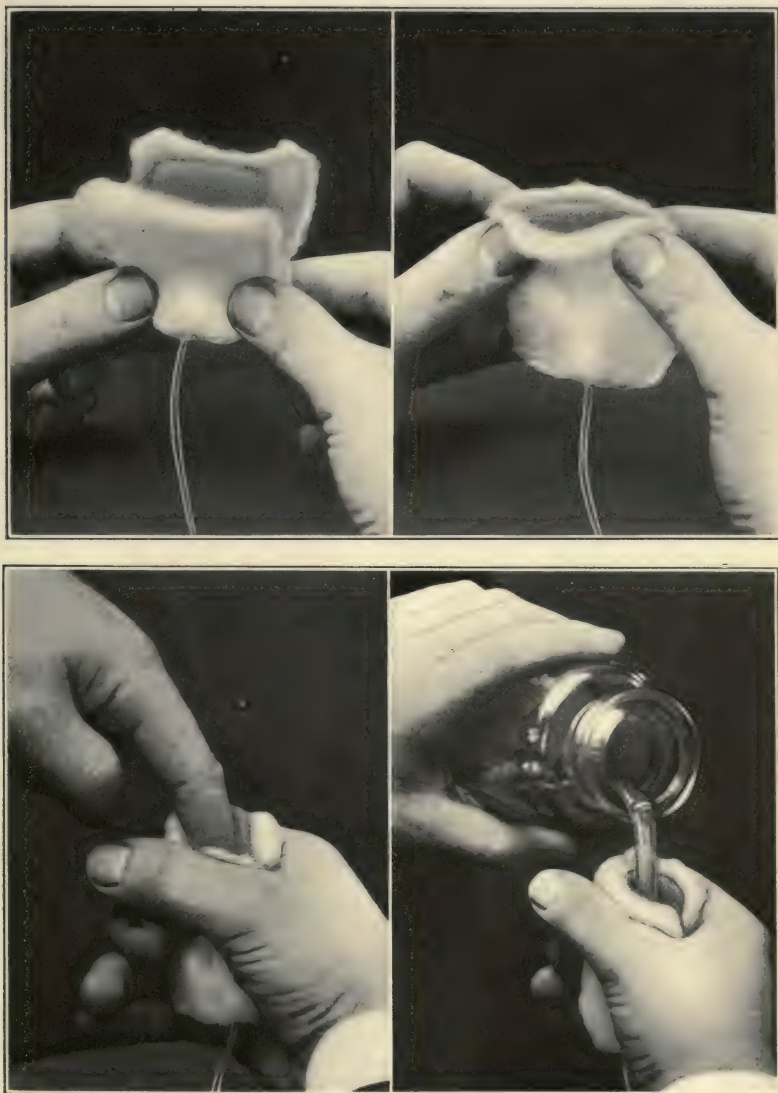
FIG. 36



Applicator.

Tenacula.—A double tenaculum is serviceable frequently to draw down the cervix in replacing the uterus or to steady the cervix when making an application (Fig. 37).

PLATE XVII



Filling a Vaginal Tampon.

By folding the tampon and molding it about the index finger it can be fashioned into a sort of cup, which will hold a considerable amount of fluid.

Syringes.—A hypodermic syringe with a blunt-pointed needle (Fig. 38) is useful for treating infection of Skene's tubules, Bartholin's ducts, and the urethra. A Keyes-Ultzman urethral syringe is the best for urethral or intra-uterine injections, and especially if the extremity is perforated along the sides and is roughened so that it may be wrapped with cotton (Fig. 39). A fountain syringe should be used for all douches, and the douche nozzle should be of glass or hard rubber, with lateral perforations (Fig. 40).

FIG. 37



Double tenaculum. Useful in the manipulation for replacing a retroposed uterus.

Tampons.—There are many forms of tampons, but the best, in my opinion, is made of lamb's wool and cotton (Plate XVI, Fig. 2). It is advisable to have several sizes ready, and some of the raw material, so that if especially large or especially small ones are required they can be extemporized. It is better to use a number of small tampons than a single large one. As usually made they are too large, and may give the patient discomfort. They may either be soaked in the solution to be used or filled with it, and then introduced by means of a bivalve or Sims' speculum (Plate XVII).

FIG. 38



Hypodermic syringe, with blunt needle for injecting Skene's tubules or Bartholin's gland.

Electric Apparatus.—For the application of galvanism a battery capable of 100 milliampères, or a wall cabinet connecting with the street, is required. Either should be fitted with a milliampèr-meter, rheostat, and commutator. The intra-uterine electrodes are made of metal, protected along the handle with rubber or gutta-percha (Fig. 41). They may be sterilized by immersion in a 1 to 200 solution of formaldehyde. The external electrode consists of a sheet of metal, 6 by 4 inches, covered with quilted gauze.

A faradic battery should have both the primary and the secondary current, permit rapid and slow interruptions, and be provided with a commutator. For intra-uterine faradization a bipolar electrode is useful; in this the positive and the negative poles are in the same electrode, but separated by a non-conducting material.

The application of electrodes to the interior of the uterus should be carried out with the fullest antiseptic precautions. The intra-uterine electrode must be carefully sterilized. The vaginal fornix and the cervix should be exposed through a good-sized bivalve speculum, and thoroughly washed with green soap, hot water, and bichloride solution (1 to 1000). The vaginal vault is then packed with pledgets of cotton which have been immersed in the bichloride solution, and these are left in place until everything is ready for the application.

The electrode should be rinsed in sterile water and, after steadying the cervix by catching it with a tenaculum, gently introduced into the uterus. The previous introduction of a sound will determine the exact direction of the uterine canal. No force should be permitted.

The external electrode (Fig. 42) should be moistened and placed upon the surface of the lower abdomen. A current of from 30 to 50 milliampères may be used for five minutes. The application should be repeated several times a week for several months. The skin of the abdomen beneath the electrode may be somewhat irritated, and show a number of small vesicles, but these usually disappear within a few hours, and give no trouble.

The faradic current may be employed two or three times a week or even daily, each application lasting from ten to thirty minutes.

Pessaries.—The pessaries which are most frequently used are the Smith-Hodge (Fig. 43) and the hard-rubber ring pessary (Fig. 44). The Hodge (Fig. 45) and the Emmet pessaries (Fig. 46) will be serviceable sometimes, and a soft-rubber ring may occasionally be preferable to a hard-rubber one. The Emmet pessary is of the same general shape as the Smith-Hodge, but its posterior bar does not rise as high and the lower bar is a little broader. It may be preferred to the Smith-Hodge when the posterior vaginal fornix is low. The Hodge pessary has a slightly concave upper bar and a broad lower bar. It may be

selected when the perineal floor is somewhat relaxed and the vaginal vault is low.

FIG. 39



Keyes-Ultzman syringe, with special nozzle, for intra-uterine injections. The tip should be wrapped with cotton into which the solution is forced after the nozzle has been introduced into the uterus. Note the lateral openings at the tip and the roughening of the surface.

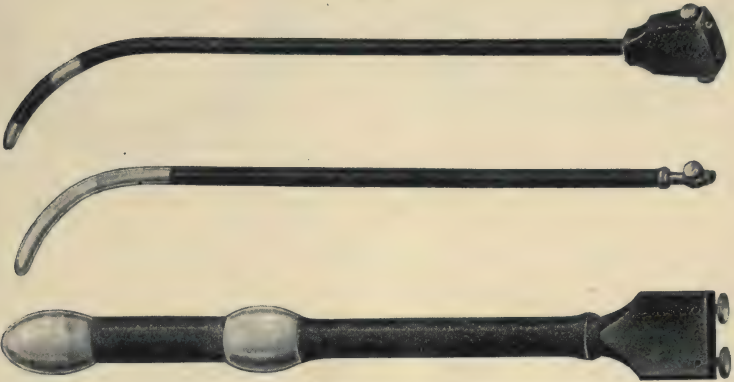
The ring pessaries are usually necessary when there is so much relaxation that neither of the other forms are sufficiently supported by

FIG. 40



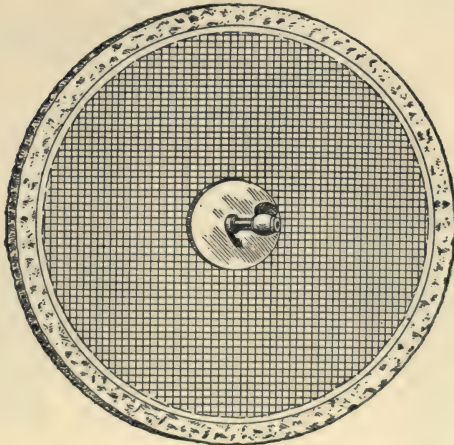
Vaginal douche nozzle.

FIG. 41



Galvanic and faradic intra-uterine and vaginal electrodes.

FIG. 42



External electrode to be placed over the lower abdominal wall.

the perineal floor. A ring pessary is held in place by the lateral attachments of the vagina and the rami of the pubes. Menge (Fig. 47)

and Schatz (Fig. 48) have modified the ring pessary, attaching a sort of rudder which maintains a position in the long axis of the vagina

FIG. 43



Smith-Hodge pessary.

FIG. 44



Ring pessary. Made of hard or soft rubber. Hard-rubber ones are usually the most satisfactory.

FIG. 45



Hodge pessary. A straight or slightly concave upper bar, with less marked upper curve and a broader lower bar than the Smith-Hodge pessary.

FIG. 46



Emmet pessary. Very like the Smith-Hodge, but the upper bar is lower, and the lower bar is broader.

FIG. 47



Menge pessary.

FIG. 48



Schatz pessary.

and thus keeps the upper supporting surface of the pessary more securely in its proper place.

There are certain principles which must be observed in the use of a pessary to insure its success. It must never be used for the purpose of exerting pressure. The uterus must be in good position before the pessary is introduced. If it is necessary to use force to maintain the uterus in a proper position, and adhesions are evident, then a pessary should not be used. A pessary should never be employed when the ovaries or tubes are inflamed or diseased, or when the ovary by its position would be pressed upon by the upper bar of the pessary. During pregnancy the pessary should be introduced only to prevent impaction of the pregnant uterus. The pessary always should be carefully selected and fitted for the individual case. A pessary should be removed every four to six weeks for cleansing, in order to prevent any irritation or soreness of the vaginal walls with which it has come in contact. After leaving it out for a few days it may be replaced, unless the uterus remains in a good position.

A properly fitted pessary does not interfere in any way with the patient's habits, and the use of douches is not necessary. The patient may pursue her usual custom in this regard.

The Vaginal Douche.—A vaginal douche may be given for the purpose of local cleansing or disinfection and to influence intrapelvic inflammation and exudate. For cleansing purposes there is nothing better than sodium biborate or sodium chloride (℥j to Oj). An antiseptic douche may consist of any of the following solutions: Bichloride (1 to 10,000 to 1 to 2000), phenol (f℥j), glycerin (f℥j), and water (q. s. ad. Oj); formalin (1 to 4000 to 1 to 2000), or potassium permanganate (1 to 10,000 to 1 to 1000). If an astringent action is desired, zinc sulphate (gr. xv to Oj) or powdered burnt alum (gr. xxx to Oj) may be added.

It is a good plan usually to give a cleansing douche first, and then, if desirable, a disinfecting one afterward. A favorite prescription of John G. Clark, to be used after a preliminary cleansing douche, is:

R—Ac. boric.	℥iij
Pulv. alum. exsicc.,	
Ac. carbol.	āā ℥ss
Ol. menthæ pip.	℥xv
Ol. gaulther.	℥xxx—M.
Sig.—℥j to Oj of water as directed.	

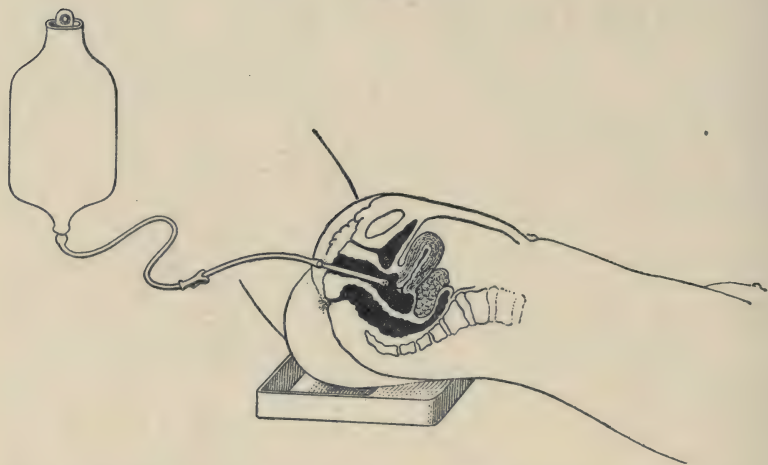
This powder, which is antiseptic and astringent, gives excellent results.

It is important to tell patients exactly how to take a douche. Unless they are given specific instructions, almost without exception the douche is taken in a sitting position, with the reservoir considerably elevated. Used in this way there is little distention of the vagina, and the process lasts but a short while, so that there is comparatively little effect either from the heat of the water or the cleansing or antiseptic materials which it contains.

To secure the greatest efficiency, either for cleansing or antiseptic purposes, the vaginal vault should be distended by the douche fluid and exposed to the action of the heat of the solution to as great an extent as possible.

For these reasons the patient should take the douche lying down, with the hips elevated upon a douche-pan; the reservoir should be not more than three feet above the patient, and the rubber tubing should be compressed, if necessary, so that the water runs very slowly (Fig. 49). For simple cleansing purposes a gallon of water is sufficient, but in order to influence pelvic exudates or inflammations as much as two or three gallons should be used. The douche nozzle should be small in caliber, with lateral openings (Fig. 40) and preferably of glass.

FIG. 49



The correct position of patient and apparatus during a vaginal douche. The patient should lie flat on her back with the hips upon a douche-pan. The reservoir must not be elevated more than three feet above the surface on which the patient lies. The tube should be compressed sufficiently, if necessary, so that the douche solution runs slowly.

When douches are used to increase the pelvic circulation and thus deplete an engorged or subinvolved uterus, and in cases of chronic pelvic inflammation, the patient should remain flat on her back for a while after the douche has been taken, or if convenient it is desirable to take the douche at night just before going to bed. It is of great advantage when the douche is used for its influence upon congested or inflamed pelvic structures to have some one assist the patient, replenishing the bag with solution when necessary, and emptying the douche-pan.

Pelvic Massage.—Pelvic massage was devised and elaborated by Brandt, who claimed a great deal for it. It is of very little use, and cannot be applied properly except by an expert. In the slow replacement of a displaced uterus when an effort is made at each visit to bring the uterus up into position, and it is gradually pushed forward during bimanual palpation and by the pressure of tampons introduced in the knee-chest position, there is a certain amount of pelvic manipulation, but this can hardly be called massage.

The Treatment of Young Women Having Pelvic Symptoms.—

It is a well-known fact that a young woman may suffer from leucorrhea, amenorrhea, or dysmenorrhea which is absolutely independent of recognizable organic lesions in the pelvis. To a girl of neurotic temperament, or one with an acquired neurosis, such symptoms may appear of terrible importance and lead her to believe firmly that she has diseased pelvic organs. It is equally true that organic pelvic disorders which need correction do occur in young unmarried women.

Such patients are usually difficult to examine: Because bimanual palpation must be made through the rectum instead of the vagina, and because the patient is almost always frightened and the abdominal wall is rigid and sensitive.

Many times under these circumstances the practitioner is in doubt, necessarily, and with the idea of studying the case farther, ascribes the symptoms to "inflammation of the ovaries" or "narrowing of the neck of the womb."

The effect of such a statement, and the effect of the local treatment which often follows, upon a neurotic patient, has frequently been such as to make her a confirmed neurasthenic, with a fixed belief that her trouble originates in the pelvis.

If the doctor is not positive that the pelvic organs are normal he should insist upon an examination under anesthesia by a competent gynecologist, when if nothing wrong is found the patient should be assured of the fact, with great positiveness, and absolutely no attention paid to the pelvis.

On the other hand, when some abnormality really exists it should be corrected by operative measures immediately or shortly after.

Local treatment should not be practised in young virginal women. They do not acquire gonorrhea except by the rarest accident. Retro-position of the uterus can scarcely ever be cured by the use of a pessary, and the vagina is too small to make the attempt. The cervix cannot be dilated aseptically without anesthesia. So that, almost without exception, local treatment is unsuccessful, and in the light of the serious mental disturbance which may follow it is reprehensible.

Therefore, all young unmarried women having pelvic symptoms should be thoroughly examined, and preferably under ether. The patient should be told positively that her organs are healthy unless some positive lesion is found. If gross disease is discovered it should be dealt with promptly by operation.

It is likely that the two disorders which will cause the practitioner most doubt are leucorrhea from glandular hypertrophy, and dysmenorrhea associated with ante flexion. Glandular hypertrophy of the endometrium may be the cause of leucorrhea, and it is often difficult to say whether an ante flexed cervix is producing dysmenorrhea or not. Under these conditions I am in the habit of telling a patient that her pelvic organs are absolutely sound and treating her by general measures. If they fail I tell the patient that curetting the uterus or stretching its neck may relieve her; but I never admit that she has pelvic disease, and assure

her that the symptoms are the result of a general condition, emanating from the uterus, indeed, but not directly referable to it.

If curettement or dilatation of the cervix then fails to cure the symptoms, and it often does, the patient will not believe that she has an incurable pelvic disease. She will understand, as her physician does, that hypersecretion from the uterus and dysmenorrhea are occasionally irremediable by any operative treatment and independent of a demonstrable lesion.

AMENORRHEA.

The first object in the treatment of delayed, scanty, or absent menstruation is to improve the general condition. To this end the patient is told how to live hygienically, and care is observed that she receive an abundance of fresh air and sunshine, and take a suitable amount of exercise. The diet should be selected, and those articles which are either hard to digest or not very nourishing should be excluded. Forced feeding with milk and raw eggs will sometimes be acceptable. Dumbbells or Swedish movements in the morning, followed by a cold bath and a brisk rub-down, are highly beneficial. Active exercise in the open air (especially golf, tennis, and horseback-riding) is of great service.

The bowels should be moved at least once every day. The addition to the diet of a cereal with cream, and a baked apple or stewed prunes may secure this result; otherwise, a pill of aloin (gr. $\frac{1}{4}$), cascarn (gr. $\frac{1}{4}$), podophyllin (gr. $\frac{1}{8}$), and belladonna (gr. $\frac{1}{8}$), may be given at bedtime. Occasionally a saline may be ordered in its place.

At the time the period is due, warm tub baths and hot foot or hot sitz baths will improve the circulation. A little mustard added to the water will increase their efficiency.

In the way of medicines the general health may be improved by the exhibition of iron, arsenic, strychnine, and cod-liver oil. These may be exhibited in various forms and combinations. I have never found anything superior to the tincture of nux vomica (m_x to xl), soda bicarbonate (gr. x), and the tincture of cardamom (f $\overline{3}$ j) before meals and a Bland's pill (gr. v) now and then modified with sod. arsenate ex. (gr. $\frac{1}{30}$), after meals, three times a day. Such treatment must be continued for months at a time. Gilliam recommends the following formula:

R \overline{y} —Liq. potassii arsenitis	f $\overline{3}$ j
Tr. nucis vomicæ	f $\overline{3}$ ij
Vini ferri amari	f $\overline{3}$ vj—M.

Sig.—f $\overline{3}$ ij after meals.

Aloes may be combined with the iron, especially when constipation is marked. Goodell gave:

R \overline{y} —Ext. aloes	$\overline{3}$ j
Ferri sulph. exsic.	$\overline{3}$ ij
Asafœtidæ	$\overline{3}$ iv

M. et div. in pil. no. c.
Sig.—One to three pills, t. i. d., before each period.

There are many so-called emmenagogues. Oxalic acid (gr. $\frac{1}{4}$) in a half-ounce of lemon syrup and water, binocide of manganese (gr. j to ij), apiol in capsules (mij to x), the oils of rue, savin, and tansy (in dose of mv in capsule), the fluidextract of cimicifuga (mxv), and potassium permanganate (gr. j to ij), three or four times a day, for two weeks before the period is due, have been recommended. Possibly the most effective emmenagogue is the combination known as Dewees' emmenagogue mixture. The formula is as follows:

R—Tr. ferri chloridi	f3ijj
Tr. cantharidis	f3j
Tr. aloes	f3iv
Tr. guaiaci ammoniati	f3iss
Syrupi	q. s. ad f3vj—M.
Sig.—f3iv t. i. d.	

It is an exceedingly unpalatable mixture.

If the amenorrhea is due to poorly developed organs and other treatment is without avail the regular and continued use of faradism (a bipolar electrode being introduced into the uterus) may possibly do some good. The negative pole of a galvanic current (15 to 40 milliampères) just before the flow is due is sometimes effectual. The stem pessary has been used for the same sort of case, with the idea of developing the uterine body.

When amenorrhea is due to constitutional disease it will be cured only by the relief of the underlying cause. In such cases the treatment must be indirect. If the menstrual flow is delayed or absent from nervous shock or fear, much can be done by reassuring the patient.

DYSMENORRHEA.

The treatment of dysmenorrhea is notoriously difficult, and drugs, almost without number, have been recommended. In every case it is advisable to make a most careful examination of the pelvic organs before any treatment is instituted. Unless this precaution is observed the patient may continue to take drugs for the relief of pain, which can be affected or cured only by some form of operation.

In many cases, however, the symptom is not dependent upon any definite pelvic lesion. It quite frequently is an evidence of poor general health and an improper and unhygienic mode of life. For that reason the diet, the exercise, and the condition of the emunctories should be carefully investigated; tonics should be administered, and suitable measures taken to bring the patient, as nearly as possible, into a normal condition. (See Amenorrhea.)

About the time the period is due, hot sitz baths, the application of a large flaxseed poultice or an ice-bag to the lower abdomen and the sacral region, or the alternation of heat and cold, may help in some cases. The coal-tar preparations, acetanilid (gr. iij), pulv. acetanilid. comp. (gr. v), or phenacetin (gr. iij), every two or three hours, are frequently

of service, and may be advantageously combined with camphor monobromate (gr. j to ij), every three hours, for nervous patients. When the pain is spasmodic, ext. cannabis indica (gr. $\frac{1}{2}$) or fl. ext. gelsemium (m j), (every three to six hours), are sometimes efficacious.

Glasgow and Palmer recommend the tincture of pulsatilla (gtt v, t. i. d.). Hirst thinks ammonium carbonate (gr. iiij) and acetanilid (gr. ij), (every hour for three doses), is as effectual and safe a combination as any. With it may be given sodium bromide (gr. v) and the elixir of the valerate of ammonium (f3 iiij). Viburnum prunifolium (f3ss of the fluid or gr. v of the solid extract every three hours), apiol (m v), three to six times daily, and the dried thyroid gland (gr. j to ij, t. i. d.) of the sheep have been recommended.

Scarification of the cervix with the abstraction of blood may be successful. Fraenkel reports good results from the use of the x-rays, but in a young woman this must be employed with great caution, because of the danger of ovarian atrophy. Garrigues says that high-tension faradization and the galvanic current are very effective.

My own practice, in severe cases which resist these remedies, is to advise dilatation of the cervix and the introduction of a Wylie drain. If the operation is refused, or if it has already been done without success, I prescribe a capsule of codeine (gr. $\frac{1}{2}$) and compound acetanilid powder (gr. v), every three hours, acquainting the patient with the fact that it is an opiate, and instructing her to take but one capsule if that is sufficient, and never more than three capsules during one period. The druggist is requested not to renew the prescription. I have never seen an ill result from this plan, and in most cases it makes the pain endurable. A stronger opiate is very rarely necessary, and if used at all, should be given hypodermically by a physician. The practice must not be continued indefinitely, and need not be if the case is carefully studied and appropriate general medicinal or local operative treatment instituted.

MENORRHAGIA AND METRORRHAGIA.

In treating a case of uterine hemorrhage, whether it is profuse menstrual flow or hemorrhage between the periods, great care should be taken to make an accurate diagnosis. It is of the first importance always to exclude malignant disease. In acute cases, when the hemorrhage is alarming, the patient should be put to bed, an ice-bag should be applied to the lower abdomen, and ergot administered in full dose (fl. ext. 3j, every two or three hours). Should this simple plan not succeed in arresting the hemorrhage the vagina must be packed, the first part of the gauze strip being so disposed as to compress the cervix. In most cases this will control the hemorrhage, especially if the vaginal tampon is aided by a firm compress and binder over the hypogastrium. In very severe cases it will be necessary to pack the uterus with gauze, but it should be remembered that this is a distinctly surgical procedure, and must be done with all antiseptic precautions and by one who is familiar with the technique.

A number of drugs may be prescribed for the cure of uterine bleeding; possibly the most uniformly successful prescription is a combination of:

R—Ergotine (Bonjean's)	. . . . .	gr. xxiv to xlvij
Ext. digitalis	. . . . .	gr. vj
Strychninæ sulphatis	. . . . .	gr. $\frac{1}{2}$
Quininæ sulphatis	. . . . .	gr. xij
M. et ft. in pil. no. xxiv.		
Sig.—One pill q. i. d.		

Digitalis, by increasing the circulatory force, often has an excellent influence upon menorrhagia. The possibility that hemorrhage may be a symptom of a syphilitic form of endometritis should be kept in mind and suitable specific treatment adopted. The cure of chronic malaria and of intestinal parasites has stopped menorrhagia. When menorrhagia is associated with circulatory disease and high arterial tension, Cumston advises rest in bed, a dry diet, and the use of arterial sedatives.

The oil of erigeron, in capsule or upon sugar (mx to xxx after meals), is said by Hare to be an excellent remedy for passive uterine oozing. Stypticin (gr. j to v), hydrastinin hydrochlorate (gr. $\frac{3}{4}$), or pulv. hydrastis (gr. v) may be given in bad cases.

If the uterus is subinvolved or retroposed, glycerite of boroglycerin tampons, hot saline douches, replacement of the uterus, and the insertion of a suitable pessary will do much good. When the pelvic circulation is sluggish, one should insist upon graduated exercise, freely acting bowels, and the avoidance of protracted sitting. Nervous individuals should be given bromides and antispasmodics. The positive pole of a galvanic current (40 to 60 milliampères) placed within the uterus is recommended by Hirst. About twenty applications are needed for fifteen to twenty minutes every other day.

In some cases good results have followed the application of the x-rays, the ovaries being exposed to its action through the abdominal wall. Young women are not suited to this plan, because it is supposed to cause ovarian atrophy. Gelatin may be used to increase the coagulability of the blood. A tablespoonful of dried gelatin with four parts of water made into a jelly should be eaten two to four times a day. The desiccated suprarenal gland (gr. iij to v) may be given four or five times daily.

Locally, in rebellious cases, if the cervix is patulous, adrenalin chloride may be injected into the uterus by means of a special syringe, the tip of which has lateral perforations and is roughened so that it can be armed with cotton. Ten to fifteen drops are used at a time. The solution is forced through the perforations after the tip has been introduced into the endometrial cavity and saturates the cotton which lies in contact with the uterine surface. Strict asepsis must be observed.

Obstinate cases must be dealt with by surgical measures.

MENOPAUSE.

As a rule, no treatment is required for the menopause. If the patient is unusually nervous and complains bitterly of the "flashes of heat," bromides or other nervous sedatives may be given. An artificial climac-

teric following operations in which both ovaries have been extirpated is more apt to require medication. The younger the patient, the more difficult is the case to handle. Fraenkel advises the use of a powder made from the lutein bodies of the ovary of the cow, and believes that it is more efficient than the ordinary ovarian extract and reports very successful results. The dose is gm. 0.3 (gr. 4 to 5) three times daily. Either or both should be given a thorough trial. Bad cases will require the services of an alienist. Recently, Maits reports the use of an extract made from human corpora lutea. The good results from the use of any of these animal extracts, when the patient knows what she is taking, may be due largely to a mental impression.

CERVICAL CATARRH; ENDOCERVICITIS; NABOTHIAN CYSTS.

For mild grades of cervical catarrh due to laceration of the cervical lips with eversion of the cervical mucosa, I have been pleased with the use of local applications of nitrate of silver (5 to 10 per cent.), followed by tampons of the glycerite of boroglycerin, either plain or containing Epsom salt to saturation. With these topical applications may be combined hot vaginal douches, careful regulation of the bowels, and exercise. The patient should be given general tonics, and among them may be mentioned Goodell's prescription of the four chlorides:

R _y —Hydrargyri chloridi corrosiv.	gr. j to ij
Liq. arsenici chloridi	gtt. xlviij
Tr. ferri chloridi,	
Acid. hydrochlor. dil.	āā f3iv
Syrupi	f3iij
Aquæ	f3vj—M.

Sig.—f3ij in a wineglass of water after meals. Do not take for more than two weeks at a time.

An excellent laxative pill recommended by Penrose is:

R _y —Ext. colocynth.,	
Ext. hyoscyami	āā gr. x
Mass. hydrargyri	gr. xx
M. et div. in pil. no. xx.	
Sig.—One t. i. d.	

When the cervical condition follows actual infection and is not purely the mechanical result of exposed and irritated mucosa, various disinfectant solutions may be used. In order to reach the infected glands it is necessary to remove the thick discharge which covers the mucosa and fills the cervical canal. This may be done with a solution of caustic soda, or alcohol, or nitrate of silver (10 per cent.), or a mixture of equal parts of the tincture of iodine, carbolic acid, and tannin, as recommended by Garrigues (Figs. 50 and 51).

The disinfectant may be either pure formalin, strong solutions of silver nitrate (20 per cent.), pure phenol, Churchill's tincture of iodine,

or argyrol (25 per cent.). When using formalin, phenol, or strong solutions of silver, the vault of the vagina must be carefully protected by packing it with wet pledgets of cotton. The application is made by means of the ordinary cotton applicator, passed as far as the internal os, and then pressed in every direction against the cervical mucosa. The solutions also may be instilled, a long glass pipette being used for this purpose. Nabothian cysts may be punctured, and if not too deep, a part of the wall removed with scissors and the interior swabbed out with nitric acid or touched with the cautery.

The treatment of endocervicitis may be unsatisfactory unless the applications are strong enough to actually devitalize the superficial parts of the cervical mucosa and produce sloughing. This entails a certain amount of danger, so that if improvement does not follow quickly it is better to treat the case surgically.

FIG. 50

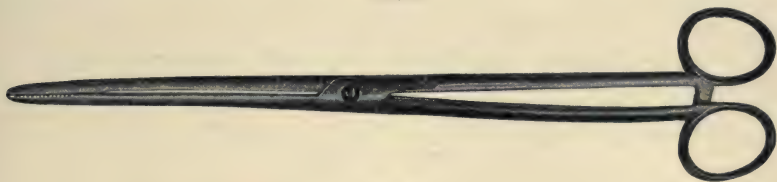


FIG. 51



FIGS. 50 and 51.—Applicator and dressing forceps. Useful in cleansing the vaginal vault and external os, and for introducing tampons. The dressing forceps is the most convenient form.

Dudley recommends a saturated solution of iodine in 95 per cent. phenol. Chloride of zinc, 50 per cent., is mentioned by Hirst, who also advises the application of the positive pole of a galvanic current, 40 milliampères, by a conical electrode wrapped in cotton and moistened with salt solution as the quickest and surest way of curing an erosion.

Hunner uses the actual cautery. He makes radical strokes, five or six at each treatment, and for a depth of one-eighth to one-sixteenth of an inch. The treatment is carried out once in three weeks. When painful, a cotton pledget soaked in 20 per cent. cocaine, is applied to the cervix previously.

Chandler has recommended the injection of pure lactic acid, by means of a hypodermic syringe, into the tissues just beneath the mucosa. A few drops are injected at a time, until the entire canal has been exposed to treatment. This may be done at one sitting, or if the patient be nervous, at several. Both of these methods depend upon the actual destruction of the diseased mucosa. Sloughing, therefore, must be expected, with its

attendant dangers, and I believe that surgical interference is decidedly preferable.

Bier's hyperemic treatment has been adapted to cervical diseases, but it has not come into general use. The suction may be applied during a half hour at a time at intervals of several days, gradually decreasing the intervals until it is applied every day. It may be used steadily for five minutes, then released for one minute, and then applied again. The reported results have been variable. Probably its most valuable effect is the removal of the thick tenacious mucus, and in this it may be a useful preparatory adjuvant to the applications of caustics or other solutions to the cervix.

After the application of antiseptics to the cervix, it is desirable to assist their action and protect the vagina by means of suitable tampons. When strong caustics have been used, tampons of zinc oxide or boracic acid ointment should be introduced. After the milder antiseptic solutions—glycerite of boroglycerin tampons, either plain or combined with Epsom salt to saturation, argyrol (25 per cent.), or ichthyol (25 per cent.) may be used. Patients should remove the tampons after a period of twelve to eighteen hours, and use an antiseptic douche daily until the next treatment.

ENDOMETRITIS.

It is very unusual to meet with a case of chronic endometritis which is suitable for any form of local treatment. A chronically infected endometrium in a majority of cases is associated with infected adnexa or with adnexa which show the results of previous inflammation. The non-infectious cases in which the discharge is due to hypertrophy of the endometrial glands, are usually combined with displacement of the uterus or with chronic pelvic congestion. In any of these events, the treatment of the endometrial condition itself becomes a matter of secondary importance, and if it does require treatment, it should usually be surgical in connection with surgical treatment to relieve the associated or underlying conditions.

A chronic discharge from the endometrium often will be influenced happily by the use of general tonics, regulation of the bowels, exercise, and the use of hot vaginal douches. The replacement of a retroposed or prolapsed uterus, and its maintenance by means of a suitable pessary will frequently relieve the symptoms.

Certain antiseptic solutions are recommended for application to the uterine cavity. Dudley first cleanses the endometrium thoroughly by wiping it out with cotton or irrigating it with water. He then injects about 1 dram of the tincture of iodine slowly and with the provision of a free egress of the fluid. He repeats this treatment twice a week, and if there is no improvement within two months, he cures. Webster selects a mixture of iodine (gr. lxx), potassium iodide (℥iss), and alcohol (f℥j), either alone or combined with tannin to saturation, or a mixture of iodine (gr. ij) and phenol (gr. viij).

In most cases it is impracticable without ether, and preparatory dilatation of the cervix to inject or apply solutions to the uterine cavity in such a manner as to be certain that every part of the endometrium has been reached and affected uniformly and without serious danger of infecting or causing inflammation of the tubes. Local applications to the endometrium are to be emphatically discouraged, and except in the rarest instances, and by an expert gynecologist, should not be undertaken.

FIBROID TUMOR.

As a rule there is nothing to be gained from anything but operative treatment. In individual instances, where the patient from age or general disability is unsuitable for operation, certain plans may be tried to reduce the hemorrhage and discomfort to a minimum. If the enlarged uterus is impacted in the pelvis and not adherent, it should be dislodged bimanually and then kept out of the pelvic cavity by the assumption of the knee-chest or the Sims position at regular intervals. The patient should be told how to avoid pelvic congestion.

Ergot may be given with the idea of assisting the uterus to expel a submucous tumor. Ergot, suprarenal gland, the x-ray, and the positive pole of a galvanic current may be used to control hemorrhage. Thyroid extract, according to Montgomery, may influence the symptoms. The dose should be gradually raised, depending on the susceptibility of the patient, up to gr. iij to gr. v a day.

PROLAPSE OF THE UTERUS.

Prolapse of the uterus usually is not adapted to palliative measures, although most cases which are to be exposed to operation may, with advantage, be given a course of preparatory treatment in order to reduce congestion and edema of the prolapsed tissues, and to heal any ulcerations resulting from pressure. In occasional cases, operation is out of the question, and then some means of support must be devised. As a rule the uncomplicated prolapsed uterus is easily replaced, the only difficulty being to keep it in good position.

When the patient is seen first the mucous membrane of the vagina and cervix should be carefully examined, and all abraded or ulcerating surfaces should be touched with a strong solution of silver (20 per cent.) or pure phenol. The uterus should then be replaced, one's manual efforts being assisted by the knee-chest or the Sims position, and a tampon introduced.

For a bad case of prolapse the best plan is to take a long strip of cotton, pass the end to the highest point in the vaginal vault, and pack it continuously around the cervix and in front until the entire vaginal vault is filled and some lateral pressure is exerted upon the vaginal fornices. The cotton packed in this way forms a sort of spherical mass, which

embraces the cervix and finds support upon the lateral walls of the pelvis and upon the pubic rami.

A soothing ointment or a dusting powder may be applied upon the cotton, and the treatment repeated at intervals of several days. After the mucous membrane is in a healthy condition a simple ring pessary of soft or hard rubber, or a Menge or a Schatz pessary, may be inserted. It should be of such a size that when pushed downward by intra-abdominal pressure it finds support upon the rami of the pubes. Great care should be taken that it does not exert too much pressure, as the mucous membrane in old women is very delicate.

The pessary should never be allowed to remain for a period longer than four weeks. After that time it should be taken out for a few days, the vaginal mucosa meanwhile being treated with 2 per cent. nitrate of silver, followed by zinc-oxide tampons. A globe pessary may be used, although it is not as commonly satisfactory as the ring. Other pessaries have been invented, which depend for their support upon a perineal band. Possibly as good as any is the Goddard pessary, but none of them are as satisfactory as the simple ring pessary. In the most exaggerated cases, however, the Goddard pessary, or one like it in principle, is the only form which will remain in place (Plate XVIII).

RETROVERSION OF THE UTERUS.

Retroversion of the uterus is frequently amenable to non-operative treatment. The first thing to determine in any case is whether the perineum is intact or well enough supported to afford a purchase for a pessary, and whether the displacement of the uterus is complicated by inflammatory or other lesions of the adnexa and immovably fixed in its bad position by adhesions. After estimating the functional integrity of the perineum, therefore, an effort should be made to replace the uterus. In simple cases this can be done by elevating the uterus and pressing the fundus upward with two fingers back of the cervix in the posterior vaginal fornix, then pushing the cervix backward by placing the finger tips in front of the cervix, and finally coaxing the fundus forward by gentle manipulations through the abdominal wall with the external hand.

It is not always possible to do this even though there are no adhesions. The uterus may be snugly fixed in the hollow of the sacrum, the intestines may be distended with feces and gas, the abdominal wall may be rigid and the patient very sensitive. Under such circumstances the effort of replacement may be made by grasping the cervix with a tenaculum, drawing it down, and at the same time pushing the fundus upward by a finger in the rectum. The cervix is then pushed backward into the hollow of the sacrum, while the external hand endeavors to draw the fundus forward by manipulation through the abdominal wall (Figs. 52 to 57). In order to avoid the promontory of the sacrum, it is sometimes a good plan to make the fundus describe a semicircle from the sacrum to the symphysis. The use of a sound (Fig. 58) to replace the uterus is unadvisable, and I have never used this method and do not sanction it.

PLATE XVIII



Goddard Pessary.

Useful for cases of uterine prolapse when the relaxation is very great and the ordinary ring, Menge, and Schatz pessaries are not effective.

The size of the uterus should be reduced by the introduction of glycerite of boroglycerin tampons three times a week, and douches of hot saline solution on alternate days. Each time the patient reports for treatment, before which she should take pains to have the bowels well moved, a gentle effort is made to replace the uterus, and the degree of replacement each time is maintained by inserting tampons in the knee-chest or the Sims position, filling the posterior vaginal fornix with small tampons and then putting one or two larger ones in front of the cervix to hold them in place (Plate XIX).

By this plan it is possible to gradually restore to a normal position a uterus which at first examination seems to be firmly fixed in the pelvis. I have no doubt that sometimes light adhesions are stretched or broken. Great care should be exercised to avoid any forcible manipulations, the best guide being the patient's sensation of abdominal pain. After the uterus has been brought up into good position, but not before, a pessary may be introduced.

I have had most success with the Smith-Hodge and the ring pessary. The Smith-Hodge pessary should be selected for cases in which the perineum is well supported, while the ring pessary may be used where the perineal floor is weakened and the support must be derived from the lateral vaginal walls and from the pubic rami. The Emmet or Hodge pessaries, which have broader lower bars than the Smith-Hodge, may be selected for cases which lie between the first and second class just described. The ring pessary may be of hard or soft rubber, but I have found the hard rubber one much more satisfactory.

There is a great deal in choosing the best form for the individual case, and a pessary often fails to give satisfaction because it is not properly selected. When the Smith-Hodge, the Emmet, or the Hodge pessary is to be used, an accurate measurement should be taken from the posterior vaginal vault to a point on the anterior wall back of the symphysis. A measurement should also be taken of the width of the vaginal fornix. The length and the breadth of the size which should be selected for the case is determined thereby.

The pessary is introduced into the vagina with the patient in the dorsal position; the upper bar is depressed by the first finger so that it slips below and glides around the cervix into the posterior vaginal vault; or, after inserting the pessary into the vagina, the woman may be placed in the knee-chest position, the vagina exposed by a Sims speculum, the posterior bar of the pessary grasped by a pair of forceps and lifted over the cervix into the posterior vaginal fornix

FIG. 58



Uterine sound.

PLATE XIX



The Vaginal Vault Packed with Tampons.

The patient is in the knee-chest position. The posterior vaginal fornix is snugly filled with small tampons, and then one or two larger ones are placed in front of the cervix to hold them in place. This treatment is particularly serviceable in the slow replacement of a retroposed uterus.

Whichever method is employed, a careful examination should be made to see that the uterus is held in good position and that the pessary is neither too large nor too small. It should be possible to pass the index finger around the instrument between its lateral bars and the vaginal wall without giving the patient any pain, and the lower end of the pessary when pressed upward should ride just back of the lower end of the symphysis without pinching the vaginal and urethral tissues. It should be determined also by the finger that the width of the pessary in the vaginal vault is sufficient so that its lateral bars ride upon the muscles of the perineal floor.

A ring pessary should be of such a diameter that it distends the vaginal fornices to their full extent, and when the patient bears down, impinges upon the lateral walls of the vagina and the pubic rami. The ring pessary does not serve to keep the uterus in ante-position so much as to prevent descensus and prolapsus. It should surround the cervix, stretching the vaginal fornices, but to such an extent only that there is no difficulty in passing the finger between the outer rim of the pessary and the vaginal wall without giving the patient discomfort.

The real test of a pessary is to allow the patient, pursuing her usual activities, to wear it for twenty-four hours, at the end of which an examination should be made, and if the pessary has given no pain, kept its position, and, most of all, held the uterus in good position, it may be regarded as satisfactory. If any of these requirements are wanting, a smaller or a larger size must be tried, and the test repeated at the end of another twenty-four hours.

A well-fitting pessary gives the patient no discomfort and does not interfere with marital relations. No special douches are required, but they may be used if desirable. If there is any unusual discharge or pain at any time the patient should consult a physician immediately. She should return once in six weeks to have the pessary removed.

The prognosis in cases of retro-position following labor are very good, and if the treatment is started within six weeks of confinement and persisted in for three months, a cure may be expected. Neglected cases, and those occurring in nullipara, congenital or acquired, are seldom cured, so that the patient may choose between continuous wearing of the pessary or an operation.

SUBINVOLUTION OF THE UTERUS.

The bowels should be moved daily with a saline laxative. The uterus must be replaced, if necessary, and kept in good position with a pessary. Tampons of the glycerite of boroglycerin should be inserted two or three times a week. Hot prolonged saline douches should be ordered. Scarification of the cervix may be of service.

A favorite tonic pill which stimulates the uterine muscle, increases the force of the circulation, diminishes hemorrhage, and increases the general tone is:

R _x —Strychninæ sulphatis	gr. $\frac{1}{30}$
Ext. digitalis	gr. $\frac{1}{4}$
Ergotine (Bonjean's)	gr. j to ij
Quininæ sulphatis	gr. $\frac{1}{4}$
Pulv. hydrastis	gr. iij—M.

Sig.—One such pill every four to six hours.

General massage will be valuable until the patient has recovered sufficient strength to exercise actively in the open air. A sitting position, straining at stool, heavy lifting, and sexual excitement should be avoided.

If these measures are unavailing, curettement is indicated because it is probable that there is retention within the uterus of portions of the placenta, secundines, or hypertrophied decidua.

CANCER OF THE CERVIX (INOPERABLE).

There are two indications, viz., to limit the foul discharge and septic absorption from the cancerous area and to control the hemorrhage. As both are met by the removal of the decomposing and necrotic tissue, the first step in the palliative treatment is a thorough curettement (under anesthesia) of the walls of the cancerous ulceration, removing the diseased tissue as completely as possible without injury to the neighboring organs. After bleeding has been checked the cancerous crater may be packed with small cotton pledgets moistened with a 100 per cent. solution of zinc chloride, or if the wall of the crater is very thin, with a 50 per cent. solution.

The surrounding parts should be carefully protected by an ointment of soda bicarbonate (3ij) and vaseline (3vi), applied directly to the vaginal surface, and a vaginal tampon should be introduced. Instead of zinc chloride, equal parts of adrenalin chloride and 10 per cent. formalin may be used. Pain may be controlled by an opiate. After twelve hours the tampon should be removed. The small pledgets come away with the first few douches.

As a cleansing and deodorizing douche, potassium permanganate (1 to 10,000 to 1 to 5000), phenol (1 to 1000), creolin (1 to 250), thymol (1 to 1000), or hydrogen peroxide (1 to 3) may be used. Hemorrhage may be controlled by a douche of adrenalin chloride (1 to 1000), tannic acid (1 to 10), or Monsel's solution (1 to 200).

Acetone has been highly recommended by Gellhorn. It is applied to the cancerous excavation, after curettement and drying, through a tubular speculum. One-half to one ounce of the acetone is poured into the speculum, the pelvis of the patient being raised as in the Trendelenburg position. After fifteen to thirty minutes the acetone is allowed to run out by lowering the patient, and the cavity is packed with a narrow strip of gauze soaked in acetone. The vagina and the vulva are cleansed with sterilized water and dried. The treatments may be repeated two or three times a week. The cancerous cavity gradually contracts, and, as it does, smaller specula are employed.

The basis of all forms of treatment is to apply to the cancerous crater some substance which will destroy the excess of proliferating tissue from time to time and prevent putrefaction. Repeated applications of the actual cautery may be used.

The pain in cervical cancer is often distressing, and although at first it may be amenable to the use of salicylates and the coal-tar products, some form of opium is finally required. Codeine should be used first, then heroin, and finally, morphine. The disagreeable effect of opiates may be reduced by combining them with strontium bromide and belladonna or hyoseyamus.

The *x*-rays have been quite disappointing in the treatment of inoperable carcinoma. In saying this I am voicing the opinion of Henry K. Pancoast.¹ Radium also is of little value.

So good a clinician as Jacobi believes that the continuous administration of methylene blue has an excellent effect. The drug should be given in pill form (gr. ij a day and increased to gr. iij to vj a day), with

¹ "X-ray therapy has comparatively little actual value in connection with the treatment of carcinoma of the uterus. With the exception of a small percentage of selected cases in which it may prove very efficient it can hardly be regarded otherwise than as a palliative measure of very variable efficiency, depending upon the particular features of each case. In a general way the value of radiation in this condition may be regarded as distinctly less than in the postoperative or palliative treatment of mammary carcinoma; but, on the other hand, distinctly greater than in malignant disease of such structures and in such localities as the stomach, large bowel, or gall-bladder. In the former the primary focus is relatively accessible, and metastatic foci in the mediastinum are, because of their anatomic surroundings, the most accessible of all internal metastatic glandular enlargements. In the latter instance, however, the primary growths are not only rapid, as a rule, in their progress, but both they and their glandular metastases are relatively inaccessible, hence *x*-ray treatment is practically useless.

"Uterine carcinoma would be included in the latter group of practically useless applications for *x*-ray therapy were it not for the fact that at least a small part, and rarely all, of the area infiltrated by the growth is accessible to direct radiation through the vagina. In a nulliparous woman or in a case with infiltration through the vaginal walls the accessible area is further lessened in extent. Growths infiltrating beyond the limits of direct exposure through a speculum, as well as metastatic foci in the pelvic glands, can be reached by radiation only through the abdominal walls, hence their treatment can be little if any more efficient than is the case with carcinoma of the stomach and other intra-abdominal organs.

"The value of radiation should be considered from the standpoint of two groups of cases: In the first group, including operable cases in which complete extirpation is possible, *x*-ray treatment is, of course, never to be considered in any sense as a substitute for operation, but it may be employed to advantage as a postoperative measure, in which application it may prove efficient in preventing a recurrence in some instances, provided it is employed at once, and used vigorously and for a sufficient length of time. If the area from which a recurrence is likely to arise is beyond the reach of direct radiation little if anything can be accomplished in this way. The most efficient application, on the other hand, would be in such cases as those in which a growth is distinctly localized to the cervix, or apparently so, and is removed early.

"The second group includes practically hopeless cases in which radiation may be used as a palliative measure. As only the area accessible to direct radiation is likely to be affected, little or nothing can be expected beyond the possible relief or lessening of pain, the occasional reduction in the discharge, the possible prolongation of life to a certain extent, or the psychic effect. The attempt to enlarge the field of direct radiation through the use of various types of cavity tubes has not proved successful for the reason that the output from such tubes is too feeble in intensity and penetration to do much if any good."—HENRY K. PANCOAST.

the extract of belladonna (gr. $\frac{3}{4}$ daily). Precautions must be taken to avoid staining the linen. Jacobi thinks methylene blue will be more efficient if the patient is exposed frequently to sunlight.

CONDYLOMATA.

The basis of all treatment is absolute cleanliness and the application of antiseptic solutions. The parts should be washed frequently with bichloride (1 to 2000), followed by normal salt solution. After drying, a dusting powder of equal parts of tannic acid and lycopodium is efficient.

An attempt may be made to destroy the warts by the application of nitric, chromic, or acetic acids, or pure formalin. The surrounding skin must be protected beforehand with vaseline, and the acids or the formalin should be applied with a glass pencil.

The warts are sometimes removed by corrosive sublimate (3ss) in collodium (3j), or salicylic acid (3j) in collodium (3j), or salicylic acid and chrysarobin (āā 3ss) in collodium (3j). As a dusting powder, Taylor recommends equal parts of calomel and salicylic acid, and Boeck speaks highly of resorcin (3viii) and boric acid and bismuth (āā 3j).

I have achieved success in some cases by ligating the warts with fine silk. Schein freezes them with a stream of ethyl chloride. This produces high-grade necrosis of the growths, and they are said to fall off within a few days. Associated or provocative diseases, such as syphilis, gonorrhea, and elephantiasis, must receive attention.

CHANCROID.

The chancroidal ulcers should be immediately cauterized with nitric acid or phenol. When the lesions are small the previous application of cocaine may be sufficient to relieve pain. In extensive cases or when the patient is nervous, nitrous oxide or some general anesthetic must be employed. After cauterization, the parts are washed with a 1 to 2000 bichloride solution and a dusting powder of iodoform is applied. The odor of iodoform may be disguised or kept at a minimum by carefully limiting it to the ulcerating surfaces, or by admixture with equal parts of powdered roasted coffee, or miv of the oil of peppermint or the oil of rose to 3j of the powder. Aristol or iodol may be used in case iodoform is inexpedient. The dressing should be repeated several times a day, and the vulvar cleft kept filled with a layer of absorbent cotton held in place by a T-bandage.

After healthy granulations have appeared a powder consisting of equal parts of acetanilid, boric acid, and calomel may be used. If the discharge is profuse, powdered tannin may be added to the dusting powder in the proportion of 1 to 4. If the granulations are exuberant, the solid stick or a strong solution of silver is indicated.

In serpiginous cases, prolonged sitz baths, a wash of nitric acid (f3j)

and water (Oj), or hot compresses of bichloride solution (1 to 5000), or of lead water and laudanum, may be used. After healthy granulations have appeared in extensive cases, a stimulating solution of the balsam of Peru and water (1 to 8) will be found advantageous.

The general condition of the patient should receive careful attention; the exhibition of iron, quinine, and strychnine, and of cod-liver oil and whisky are often of service.

At the first appearance of the symptoms of bubo the patient should be confined to bed and an ointment, composed of equal parts of ichthyol and mercury, belladonna and iodine ointments, applied to the affected region. A snug bandage should exert firm, equable pressure upon the inflamed gland. If suppuration is imminent the case becomes surgical.

PRURITUS.

The particular treatment chosen for a case of pruritus is largely governed by the cause and whatever may be selected to relieve the immediate suffering, it is well to give great thought to the general health and to inaugurate appropriate measures of relief for such disorders as icterus, nephritis, diabetes, and heart disease.

The local treatment consists essentially in keeping the parts absolutely clean and applying some sort of a sedative ointment, powder, or wash. If the symptoms are caused by pediculi, a solution of bichloride of mercury (1 to 500), in equal parts of alcohol, water, and ether, will give good results. Pruritus caused by the itch insect may be treated by sulphur ointment (U. S. P.) or by betanaphthol, gr. xxxv to ʒj of lanolin.

Pinworm pruritus will yield to rectal irrigations of the infusion of quassia, and to half-ounce doses of the fluidextract of senna, and the fluidextract of spigelia. Pruritus is sometimes caused by trichiasis, that is, the growth of short and stiff inverted hairs. These should be extracted with suitable forceps or destroyed by electrolysis. If there is an irritating discharge from the vagina a vaginal douche (soda bicarbonate and soda biborate, of each a half-ounce to a gallon of warm water) should be administered two or three times a day, and afterward the vulva should be thoroughly dried and the vagina filled with tampons to catch any discharge which may come from the upper genital tract.

If the urine is highly concentrated, potassium citrate, in full dose, should be given, and if the urine contains pus, benzoic acid and urotropin, of each gr. v to x, every three hours, will be efficacious.

Rectal discharge should be controlled by frequent irrigation of the rectum, with a normal saline solution, followed by the injection of two ounces of a 25 per cent. solution of argyrol, or of a 2 to 5 per cent. solution of silver nitrate. If a rectal discharge comes from a lesion far above the anus, high irrigation of the colon and the exhibition of intestinal antiseptics must be practised.

After thorough cleansing of the vulva, I believe that nothing will be more soothing in the way of an ointment than the ordinary official oxide

of zinc; 5 per cent. phenol increases its efficiency, or a dusting powder of the oxide or the stearate of zinc may be used. Irritated surfaces must be kept apart by the interlacement of cotton.

In very severe cases a strong solution of cocaine (20 per cent.) may be used, or a dusting powder of morphine (gr. j) and prepared chalk (gr. ij), may be rubbed in daily; or, better yet, the patient should be kept in bed and hot applications made of lead water and laudanum.

Combinations almost innumerable have been devised to relieve the itching. Among them may be mentioned a formula of Garrigues: Plumbic oxide (℥j), olive oil (f ℥ijj), water (℥iv); boil over a slow fire to the consistency of cream. Small has had the best results from turpentine and unguentum petrolatum (1 to 2).

Montgomery recommends equal parts of alum and sugar, also chloroform in glycerin (1 to 8), or hydrocyanic acid (2 or 3 drops to the ounce of water), or 10 per cent. guaiacol in vaseline. Hirst mentions the infusion of tobacco, vinegar, vaginal suppositories of ichthyol and glycerin, the subcutaneous injection of normal salt solution (1 to 3 liters), the *x*-ray, faradism, the rapid interrupted galvanic and the high-frequency static current.

Penrose speaks of equal parts of prepared chalk and bismuth subnitrate, or a mixture of corrosive sublimate (gr. $\frac{1}{2}$) and the emulsion of bitter almonds (f ℥j). Monk says that Goulard's extract, menthol, and chloral ointments (5 to 10 per cent.) may be effectual; also Hofmeister's emulsion:

R—Potassii bromidi	℥ij
Lupulini	℥ij
Hydrargyri chloridi mitis	℥x
Ol. olivæ	f℥xx

Dudley employs pure phenol or pure ichthyol and an ethereal solution of iodoform. Gilliam mentions a formula of Tait's for inveterate cases, especially senile ones: Lime (1 pound), sulphur (2 pounds); put in three gallons of water and boil down to a gallon and a half. Use locally. A strong solution of silver nitrate (gr. lx to ℥j) may give relief in some cases.

Noble says that nothing is better for the itching of a dermatitis than black wash and bismuth. When pruritus is a symptom of a primarily cutaneous lesion of the vulva, the disease, whether it be eczema, intertrigo, or something else, requires much the same treatment as it would elsewhere. (See Vulvitis.)

In some cases pruritus cannot be ascribed to any demonstrable affection, and then may be regarded as a neurosis and treated accordingly.

The diet will require regulation in many instances. The patient should avoid highly seasoned and highly nitrogenous food, and the prolonged use of and addiction to certain drugs, such as morphine, quinine, iodine, and alcohol must be forbidden.

STERILITY.

Little can be done by non-surgical measures, and nothing should be attempted unless it is proved that the husband is potent. A displaced uterus should be replaced and held with a pessary. An ill-developed uterus may be treated by galvanism, the negative electrode being passed into the uterus, and the positive placed upon the abdomen. A current up to 50 milliampères, for five minutes, to or three times weekly, should be used, and the uterus lightly massaged afterward. Such treatment has been successful, according to Bumm, in enlarging the uterine body, and if it does this it may increase the probability of conception.

If the cervix is acutely anteflexed and the canal is long and narrow, dilatation of the canal is indicated. This should not be attempted as a form of local treatment, but as an operation.

Hypersecretion from the uterus, the result of endometritis or endocervicitis, may be favorably influenced by the treatment already mentioned (endocervicitis) (endometritis). If there is an especially acid leucorrhea, a vaginal douche of bicarbonate of soda (3j to Oj), immediately before coitus, may be of service.

When the vaginal vault is shallow and ill-developed it should be repeatedly packed with tampons of increasing size in the hope of making it more capacious. In such cases the woman should remain flat on her back after coitus, with the hips raised on a pillow. Frequent coitus is to be discouraged. The most likely time for conception is immediately after the menstrual period.

When there are inflammatory lesions of the tubes, non-surgical measures are likely to be unavailing, and the patient should not be promised much from local treatment nor subjected to it for a long time. If there is stenosis of the cervical canal, a badly infected or diseased cervix which does not rapidly yield to treatment, hyperplasia of the endometrium, uterine or adnexal adhesions, or other gross pelvic disease, the only hope lies in operative treatment.

Curettement, amputation of the cervix, dilatation of the cervical canal, and the introduction of a Wylie drain, splitting the posterior cervical lip, or Dudley's operation, the release of uterine or tubal adhesions, salpingostomy, all may do some good.

When the ovaries are small or impalpable, when severe dysmenorrhea, and a scanty and delayed flow indicate poor development, it is unlikely that any form of treatment will be successful. Intra-uterine galvanism may be tried. In every case of ill development the general health should receive special attention, and tonics, well-regulated exercise, baths, and hygienic measures may produce good results.

SYPHILITIC ERUPTIONS.

The general treatment is of the most importance. No local treatment for chancre is necessary, except frequent bathing with 1 to 4000 bichloride solution and the use of equal parts of acetanilid, boric acid, and calomel as a dusting powder. The patient, of course, should be warned of the contagious nature of the infection. Mucous patches and condylomata should be painted with nitrate of silver (5 to 10 per cent.) and dusted with iodoform, aristol, or subiodide of bismuth. An iodoform ointment is recommended by Garrigues, the formula of which is as follows:

R_y—Iodoformi,
 Balsam peruviani āā ʒj
 Petrolati ʒj—M.
 Sig.—Apply locally.

URETHRAL CARUNCLE.

After applying a strong solution (10 to 20 per cent.) of cocaine, a fine double silk ligature is passed through the base of the growth and tied on each side. The greater part of the caruncle is then snipped away with scissors. The caruncle may be so situated, or of such a form and size that this treatment is impracticable without anesthesia.

CYSTITIS.

During the acute stage of cystitis, when there is fever and general disturbance, the tincture of aconite may be added to the usual potassium citrate mixture, as in the following formula recommended by Hare:

R_y—Tr. aconiti mxxxvj
 Sp. ætheris nitrosi fʒvj
 Liq. potassii citratis q. s. fʒvj—M.
 Sig.—fʒiv every four hours.

The tincture of belladonna may be included (m_v to x) if there is much tenesmus, or hot rectal enemas, vaginal douches, or sitz baths may be employed. If these and the prescriptions already recommended do not relieve, opium is indicated, either in the form of an opium and a belladonna suppository, or in a mixture of the deodorized tincture of opium and starch water, which may be injected into the lower bowel.

Acute cystitis is usually not as difficult to relieve in the female as in the male, and most of the cases seen in practice are of the subacute or chronic type. Before treatment is started an examination should be made to determine the composition of the urine. If it is acid, a soothing and favorite prescription is 1 to 2 drams of potassium citrate daily, dissolved in 1 to 2 pints of flaxseed tea; or, instead of flaxseed, the infusion of buchu or of uva ursi. Salol (gr. v), every three hours, may be used

PLATE XX



Irrigating Apparatus for Bladder.

The catheter should be introduced with the apparatus filled. Irrigation is accomplished by alternate raising and lowering of the funnel. The organ should never be completely nor rapidly drained lest the vesical mucosa is sucked into the eye of the catheter and injured. The picture shows that air has been introduced into the bladder with the irrigating fluid. This can be avoided by a careful and correct technique.

at the same time for its antiseptic properties. If the urine is alkaline, one may employ benzoate of ammonia (gr. v to x) or boric acid (gr. v to x) to render it acid, and in addition, urotropin (gr. v to x every three to six hours) to act as an antiseptic.

When pus is present in subacute or chronic cases it is advisable usually to practise some form of irrigation. I commonly employ warm salt solution, although Hunner recommends Thompson's fluid, which is composed of borax (℥j), glycerin (f℥ij), and water (f℥ij).

The technique of irrigation is of greater importance than the selection of the irrigating fluid. A glass funnel, a soft rubber catheter, a section of rubber tubing, and a glass connecting joint are necessary. The tubing should be filled with the solution before the catheter is introduced into the bladder, and during irrigation, which is accomplished by alternate elevation and depression of the reservoir, care should be taken lest the bladder becomes so completely emptied that the mucosa is sucked into the eye of the catheter. To this end, the reservoir should never be elevated or depressed to a marked degree (Plate XX).

After irrigation an ounce of argyrol solution, 20 per cent., and freshly made, may be left in the bladder, directing the patient to delay micturition for as long a time as possible. Iodide of silver in quince-seed mucilage forms a very soothing and a very excellent substitute for argyrol. In the more obstinate cases, nitrate of silver solution, from 1 to 4 ounces, may be used, beginning with a strength of 1 per cent., and then increasing up to 3 per cent., if necessary. If there are actual ulcerations of the vesical mucous membrane, they may be touched, through a Kelly cystoscope, with nitrate of silver, fused upon a silver probe.

Webster advises for irrigation a solution of formalin, 5 minims to 1 pint of salt solution. To prevent phosphatic deposits, he uses citric acid, 8 to 10 grains to the pint. Hunner employs nitrate of silver from 1 to 5000 to 1 to 500; also corrosive sublimate from 1 to 150,000 to 1 to 5000.

Nitrate of silver is usually of no use in tuberculous cystitis; bichloride is preferable. Hunner injects 15 to 30 cm. of a 1 to 20,000 solution, and if this is well borne the strength is rapidly increased, but never above 1 to 500. He has been obliged for weeks to be satisfied with a solution of 1 to 40,000. The treatment is given once or twice a week. Amelioration of the symptoms is first noticed with regard to the pain. Later, the frequency is reduced. At first the treatment increases the pain, when, previous to the irrigations, it may be desirable to use morphine.

In chronic cystitis, cubebs, copaiba, sandal, eucalyptus, and turpentine may be prescribed, and Hare speaks well of juniper, either as the compound spirit of juniper or as the infusion, alone or with potassium bitartrate.

URETHRITIS.

The most frequent form of urethritis which requires treatment is due to the gonococcus. Other varieties of urethritis are usually less violent and less persistent, but whatever the cause, the treatment does not differ essentially.

No local treatment is advisable during the acute stage. The urine should be rendered as bland as possible by encouraging the patient to drink large amounts of water and by ordering the same diluent diuretics as were described in the treatment of cystitis; or potassium bicarbonate (gr. v to x) combined with salol (gr. v) may be administered every four hours. There is a natural tendency for urethritis to be self-limited in the female, and the symptoms are never as violent as in a person of the opposite sex.

After the acute symptoms have subsided, and the disease is largely localized to the anterior part of the urethra and Skene's tubules, local treatment may be started. The patient should present herself with a full bladder. The urethra is massaged through the anterior vaginal wall and all the pus expressed from the urethral crypts and Skene's tubules. Urination, after this procedure, cleanses the urethra thoroughly, washing away from within outward all of the gonococcus pus and leaving a clean surface for the application of antiseptic solutions.

By means of a blunt-pointed hypodermic needle, Skene's tubules are in turn distended with a fresh 20 per cent. solution of argyrol or with pure ichthyol. A piece of cotton is rolled loosely upon a fine applicator into a cylinder about one inch in length and from one-eighth to one-quarter of an inch in thickness (Plate XXI), and slightly moistened with sterile water. The cotton is introduced into the urethra to its full length, the applicator detached, and the cotton saturated with a 50 per cent. solution of argyrol by means of a long blunt hypodermic needle, which is carried into the urethra for about an inch. This urethral tampon of argyrol is left in position until the patient next voids urine, when it is passed usually without any difficulty. Internally, a soluble elastic capsule of 5 minims each of salol and copaiba, three times daily, should be prescribed.

By this plan one is able, as a rule, to thoroughly eradicate the disease, and I believe it is superior to irrigations or injections. It is very important that the patient drink large quantities of water, that the urethra is thoroughly milked of discharge and the bladder emptied just before the tampon is inserted, and that a urinary antiseptic, such as copaiba and sandal, be given internally. It is also important to treat the patient at least every other day, and, if possible, every day, and that reinfection be absolutely avoided.

Soluble urethral bougies with a base of cocoa butter and impregnated with argyrol or protargol, carbolic acid, or ichthyol may be used, being inserted into the urethra and left to dissolve there.

If injections are preferred the same preliminary treatment should be carried out. The urethra should be compressed at the neck of the bladder by a finger in the vagina, during the injection, and not more than fifteen to twenty drops of the solution should be used at a time. A 20 per cent. solution of argyrol may be employed, or, in the later stages, a slightly astringent injection, such as that recommended by Small.

PLATE XXI



Urethral Tampon.

A piece of cotton is rolled into a cylinder upon the ordinary applicator. After the tampon has been inserted into the urethra the applicator is released and withdrawn.

R—Zinci sulphatis,
 Pulv. alum. ex. āā gr. xv
 Phenolis gr. iv
 Aq. destillatæ f3iv—M.
 Sig.—Use as an injection.

In chronic cases a 20 to 50 per cent. solution of argyrol, pure phenol, followed by alcohol, or silver nitrate (3 to 10 per cent.), may be applied to the entire urethral canal through the urethroscope. Such heroic treatment is rarely necessary. If there is a tendency to stricture (also very unusual) or a persistence of infection in the urethral crypts, Finger's ointment may be used upon a full-sized corrugated sound.

R—Potassii iodidi 3iss
 Iodi (pure) gr. xv
 Ol. olivæ f3iss
 Lanolini 3iij—M.

If cystitis or vulvitis accompanies urethritis they should receive coincidently the treatment which has been (cystitis) or will be (vulvitis) described. If bladder irrigation is decided upon, care should be taken to disinfect the vulva and urethra as thoroughly as possible before a catheter is introduced, and a certain amount of antiseptic solution should be left in the bladder to be voided, in this way washing any infectious products from within outward.

If the infection remains obstinately localized to Skene's tubules they should be laid upon freely with a sharp bistoury and wiped out with pure phenol, or cauterized with the hot silver probe.

CYST OF BARTHOLIN'S GLAND.

Although this condition should usually be treated by complete excision, it is possible in some cases, by evacuating the cyst through a hollow needle, and then injecting ten drops of a 1 to 10 solution of zinc chloride, to cause obliteration of the cyst cavity.

VAGINITIS.

The treatment of acute vaginitis consists of rest in bed, saline laxatives, and the use of warm vaginal douches of sodium chloride, sodium bicarbonate, or borax (3j to Oj) solutions. If the pain is very great these douches must be given with great gentleness, through a soft rubber catheter instead of the usual douche nozzle. Opium and belladonna suppositories may be necessary to relieve the pain. The discharge should be caught upon vulvar pads, which are burned afterward.

If the attack is gonorrheal in origin the patient should be warned of its infectious nature and the danger of transferring the infection to the eyes. In the gonorrheal vulvovaginitis of children, complete isolation is advisable if there are other children in the same family or institution.

The child should have its own individual nursing bottles, napkins, etc. No tub baths should be given, and the cotton or gauze used in bathing should be burned.

After the acuteness of the attack has subsided a douche of weak bichloride (1 to 10,000) may be employed, and tampons of argyrol (10 to 25 per cent.) in benzoated lard may be applied to the vagina.

When the pain and tenderness are inconsiderable, but the infection still remains, an application of argyrol (50 per cent.) or of nitrate of silver (3 to 10 per cent.) may hasten the cure.

In the chronic stage, after a cleansing douche, an astringent solution of zinc and alum (āā gr. xv to Oj), or potassium permanganate (1 to 4000) is advisable. Tampons of ichthyol (25 per cent.) or carbolized vaseline (5 per cent), or mercury and belladonna ointment, or boracic-acid ointment may be serviceable (Fig. 59). Webster uses the following mixture upon tampons:

R—Glyceriti boroglycerini	f5j
Alumen exsiccati	5j
Glycerini	q. s. ad Oj—M.

FIG. 59



Hard rubber spatula for applying ointment to tampons.

VULVITIS.

In order to insure cleanliness, the vulva should be washed with a solution of bicarbonate of soda and sterile water (3j to Oj), several times a day. Appropriate treatment should be carried out for complicating or causative lesions. Thus, threadworms; diabetic urine, and irritating discharges should be dealt with as has been described under the treatment of pruritus. When the inflammation is due to the gonococcus or some other form of infection, bichloride of mercury (1 to 4000) should be used as an antiseptic, followed by sterile water and careful drying. The entire vulva may then be painted with a 25 per cent. watery solution of argyrol, and strips of gauze soaked in the same solution may be placed between the labia.

Instead of the bichloride solution, potassium permanganate (1 to 1000) or a solution of carbolic acid (1 to 100) may be prescribed. The solution should be poured over the vulva or applied by means of cotton balls held in dressing forceps. In gonorrheal vulvitis, if it is possible that the infection is confined to the urethra and Bartholin's glands, vaginal douches must be avoided. When there is a great itching or burning, hot applications of lead water and laudanum should be made.

As the symptoms subside, 1 per cent. of powdered burnt alum may

be added to the lead water and laudanum, if that has been necessary, or an astringent douche of zinc sulphate and alum in water (āā gr. xv to Oj) may be substituted. Hot fomentations of witchhazel also are sometimes effectual for the relief of pain or itching. General measures, such as rest in bed, saline laxatives, and refrigerant diuretics, are important. The vulvar cleft should be filled with gauze or cotton to catch the discharge and keep the inflamed surfaces apart. When there is no longer great burning or tenderness, stronger antiseptic solutions may be applied directly to the vulva, such as nitrate of silver (5 to 10 per cent.), bichloride of mercury (1 to 500), argyrol (50 per cent.), and formalin (1 to 500). The apposed surfaces of the vulva should be kept separated and protected either with plain or carbolized oxide of zinc ointment or with a dusting powder, such as equal parts of calomel and bismuth, or equal parts of tannic acid and bismuth.

Following gonorrheal vulvitis, infection is likely to remain in Bartholin's glands, and special attention should be paid to them, injecting into their ducts by means of a blunt hypodermic needle, 25 per cent. ichthyol or 25 per cent. argyrol. Should the disease persist in spite of treatment, they must be laid open freely and cauterized with phenol or a hot silver probe, or dissected out entirely.

For itching, I have prescribed with success the following:

R—Phenolis	℥j
Glycerini	f℥ij
Alcoholis	f℥ij
Aq. rosæ	q. s. f℥iv

Or the following calamine lotion:

R—Calamini	℥iv
Zinc oxidi	℥iiss
Glycerini	f℥v
Aq. calcis,	
Aq. rosæ	āā f℥x—M.

In the form of vulvitis known as follicular the affected follicles should be opened and the hair removed with forceps. In obstinate cases the follicles may be destroyed by means of a fine galvanocautery. The general health should receive attention. Iron and cod-liver oil may be prescribed with advantage in debilitated conditions. In gouty women the salicylates and lithia are useful. Compresses of bichloride (1 to 1000) or of ichthyol (10 per cent.) have been recommended, followed by ointments containing ichthyol (10 per cent), phenol (gr. v to ℥j), or white precipitate (gr. x to ℥j).

When there is an erythematous eruption associated with diabetes the parts must be thoroughly cleansed and compresses of sodium hyposulphite (℥ss to Oj) or of linseed oil and lime water may be kept in contact with the inflamed surfaces.

In eczema, Montgomery uses a starch or a slippery-elm poultice to remove the crusts. After cleansing, an ointment of ammoniated mercury (gr. xv to ℥j) or of acetanilid (℥j), menthol (℥ss), and lanolin (℥j), or of iodoform (℥j), zinc oxide (℥ij), and lanolin (℥iij) may be applied.

For intertrigo, Ravogli recommends absolute cleanliness and dusting with rice or starch powder plus 2 per cent. of boric or salicylic acid, or the following ointment:

R—Zinc. oxid.,		
Bismuth subcarb.	āā	℥ss
Phenolis		gtt. x
Vaselini		℥j

If the intertrigo is chronic and there is papillary hypertrophy, he orders:

R—Sulph. sublimat.,		
Liq. picis	āā	℥vj
Saponis viridis		
Terræ albæ		℥iij
Adipis suis		℥j

Or,

R—Resorcini		℥ss
Ac. salicylis		gr. vj
Vaselini flav.		℥j

SALPINGITIS.

The treatment of acute salpingitis in the early stages is non-surgical. The patient should be put to bed, food should be withheld, and an ice bag or a large flaxseed poultice, whichever is most comforting, should be placed upon the lower abdomen. As a rule it is a good plan to secure free evacuation of the bowels by the administration of Epsom salt, a half ounce of a saturated solution every hour, assisted, if need be, by an enema.

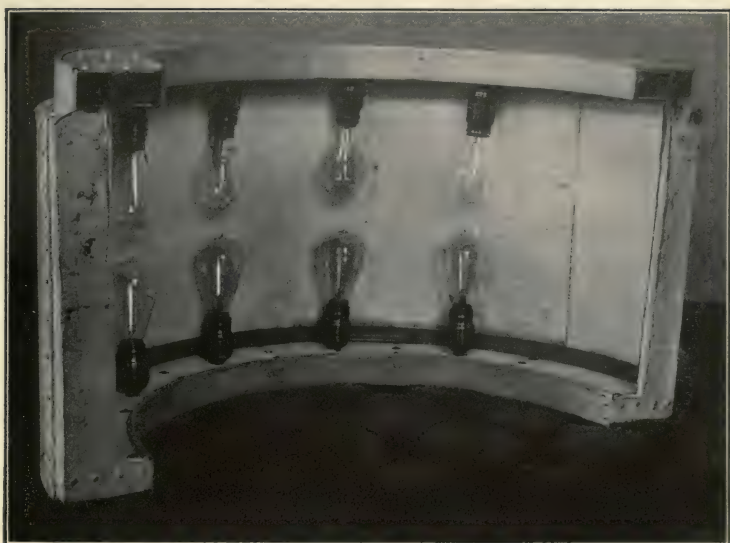
After the bowels have been well moved no further cathartic is necessary, abdominal distention being relieved when desirable by the use of a high enema of Epsom salt (℥ij), glycerin (℥ij), and water (q. s. Oj). With an acute salpingitis there is always a certain amount of pelvic peritonitis, and if the inflammation affects the right tube particularly, there may be difficulty in distinguishing between it and appendicitis.

If primary appendicitis can be excluded with tolerable certainty, if there are no symptoms which indicate a general involvement of the peritoneum, and if the rigidity, tympanites, nausea, and vomiting are moderate in degree and yield to the measures described, the latter may be continued.

After the acuteness of the symptoms has abated, hot saline or mild bichloride (1 to 5000) douches may be added to the treatment, and liquid nourishment in small amount may be allowed. If the diagnosis is not clear, if primary trouble with the appendix is strongly suspected, or if the symptoms do not abate, surgical interference is at once required.

Salpingitis is almost always gonorrheal, and the purpose of expectant treatment is to localize the inflammatory process to the pelvis and to absorb the peritoneal exudate which is thrown out during the acute stage. It also results in an attenuation or even death of the infecting organisms, and reduces the amount of destruction of the pelvic structures to a minimum, so that when an operation is performed later it is safer,

PLATE XXII



Gelhorn's Superheated Air Apparatus.

Seen from the inside. Made of wood coated with asbestos and furnished with eight sockets for either 16 c. p. or 32 c. p. electric bulbs.

PLATE XXIII

FIG. 1

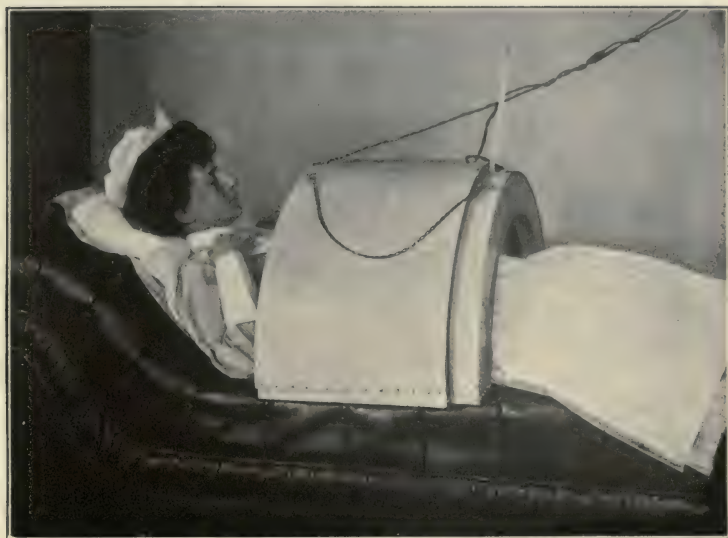


FIG. 2



Gelhorn's Apparatus in Use.

and more conservative measures may be adopted than if it had been undertaken during the acute stage.

Under this expectant plan the symptoms usually abate, so that in the course of from three to five days the temperature and pulse have fallen to normal or nearly so, and the patient feels tolerably well. Operation often may be performed safely at this time, but it is better to continue the use of hot vaginal douches and hot applications to the abdomen for a week or ten days longer. The patient then may feel completely relieved and question the necessity of an operation.

The benefit of the treatment results largely from the moist heat applied to the vaginal vault and the lower abdomen. Polano uses for the same purpose a hot-air casket like those commonly employed in the treatment of chronic articular infection. His plan has not met with very general use in this country, although Gellhorn recently devised an apparatus which is simple in construction and which can be fashioned almost anywhere (Plates XXII and XXIII).

In addition to the hot-air casket, hot sandbags upon the lower abdomen and a colpeurynter filled with mercury and introduced into the vagina have been much employed, especially in Germany. Many of the German authors report entire relief of the symptoms and even anatomical cures by persisting in these plans.

Although I believe the use of the hot-air casket worthy of a careful trial, the same amount of good may be obtained by the use of frequently repeated, copious hot vaginal douches, and by the continuous application to the lower abdomen of thick flaxseed poultices. In a majority of cases after the acute symptoms have subsided, there remain definite pelvic lesions which yield only to surgical intervention, but the prognosis, both for the patient's life and for the extent to which conservatism may be carried, is much better if hydrotherapeutic measures are adopted for a considerable time beforehand.

In chronic salpingitis the symptoms may be kept in abeyance by a life of ease, careful regulation of the bowels, the use of glycerite of boroglycerin tampons, and hot douches. Comparative comfort in some cases seems compatible with hard work, although the patient usually suffers at the menstrual periods if at no other time.

GONORRHEA.

The treatment of gonorrhea has been detailed in connection with the lesions it produces, viz., urethritis, vulvitis, vaginitis, endocervicitis, endometritis, and salpingitis.

The management of the individual case, of course, varies with the extent of the lesion. When a patient presents herself with an acute attack, exhibiting symptoms of frequent and painful urination, burning about the vulva, and leucorrheal discharge, a mixture should be given to render the urine as bland as possible (see Cystitis and Urethritis), and the vulva should be frequently cleansed with mild antiseptic solu-

tions (see Vulvitis). In the acute stage no vaginal douches are permitted, and it is desirable, until the external inflammation is under control, to avoid vaginal examination or instrumentation of any sort.

The diet must be bland, and if the patient is so situated that she can afford to rest in bed until the acute stage has passed, it is very desirable to do so.

After a few days the cervix may be exposed through a bivalve speculum following preliminary disinfection of the vulva, so that no organisms are carried to the cervix. The extent of the initial infection can in this way be determined, but no local treatment except external applications should be used until the acute stage has passed.

The two principal factors in the successful treatment of gonorrhea are frequently repeated visits to the physician's office and the absolute avoidance of a reinfection: The first, because a woman is not able to do anything for herself, and any form of treatment to be effectual must be repeated at short intervals; the second, for obvious reasons. The treatment must be continued until smears from the urethra, Bartholin's glands, and the cervix fail to show the gonococcus.

Serumtherapy, in the hands of Taylor, Torrey and Rogers, Butler and Long, Churchill and Soper, has met with varying success. It seems to be more successful in children where the difficulty of local applications is quite evident. Certainly, up to the present time, there is no well-established proof of the usefulness of the method. It may be employed as an adjuvant in stubborn cases which do not yield to local treatment.

Belfield, after a thorough review of the subject of bacterin therapy, says: "It is needless to employ a strain of gonococci like that of the patient; stock vaccine is quite as efficient as one prepared from the subject; the vaccines have a marked curative effect upon gonorrheal rheumatism; the vaccines materially fail to influence gonorrheal infections of mucous membrane in the genital tract or elsewhere." Those who desire to use this method of treatment are referred to the papers of Irons¹ and Herbst.²

DISEASES OF PREGNANCY AND THE PUERPERAL STATE.

Eclampsia.—The prophylactic treatment of eclampsia will be discussed in connection with the toxemia of pregnancy. The indications in eclampsia are to control convulsions, stimulate the emunctories, and evacuate the uterus.

For the control of convulsions the most convenient and quickest drug is chloroform. This should be given during a convulsive attack or as soon as there are indications that one is about to occur. Certain other drugs may be recommended for the same purpose.

¹ Journal of Infectious Diseases, June 4, 1908.

² Journal of the American Medical Association, May 23, 1908.

Chloral has been advocated by Charpentier and von Winckel. It is exhibited in large dose (gr. xxx to lx) by the bowel. As much as 3 drams, or even more in bad cases, have been given in twenty-four hours.

Veratrum viride is a very efficient drug, and is said by Edgar to be second only to chloroform for controlling convulsions. It reduces blood pressure and may be exhibited in any case when the pulse is strong and rapid. Convulsions almost never occur when the pulse has been diminished below 60 by this drug. It is said also to relax the cervix, reduce temperature, and promote diaphoresis and diuresis. The initial dose should be 10 to 20 minims of the tincture hypodermically, and this should be repeated every half-hour until the pulse falls below 60.

Morphine (gr. $\frac{1}{2}$) may be given immediately, and repeated, if necessary to control the convulsions, at two-hour intervals in one-quarter grain dose up to a maximum of 2 grains in twenty-four hours. There is a natural prejudice against morphine on account of its effect upon the urinary and other excretory functions. The good results obtained at the Rotunda Hospital and by Veit compel the belief that ordinarily it is a valuable method of treatment, but, as pointed out by Hirst, it is not permissible if the patient has an interstitial nephritis.

Convulsions are also more or less controlled by the application of ice-bags to the back of the head and the neck, and by keeping the patient as quiet and free from disturbance as possible.

Elimination from the bowels may be secured by croton oil (gtt. 1 to 2 in f $\overline{3}$ j of sweet oil) placed on the back of the tongue, or elaterium (gr. $\frac{1}{4}$ in butter), or a concentrated solution of magnesium sulphate (3ss) every half hour, given by the mouth; or these drugs may be introduced into the stomach through a tube after gavage. Compound jalap powder (gr. xxv) may be used as a cathartic, or repeated high enemas of concentrated Epsom salt.

Elimination from the skin is usually secured by a hot moist pack or a hot vapor bath. Pilocarpin is dangerous, and has caused fatal edema of the lungs, but in a case of great severity, a single dose (gr. $\frac{1}{6}$) may be permissible for the purpose of free perspiration.

Elimination by the kidneys is favored by hot poultices about the loins, the exhibition of nitroglycerin (gr. $\frac{1}{50}$ every three hours), and the repeated introduction of saline solution under the skin and into the bowel. The exhibition of diuretin (gr. xv) or calomel (gr. j), every three hours if the patient can swallow, will favor free action of the kidneys.

Another means of eliminating the poison is by venesection. This may be done in any case, but the indication is more decided when the pulse is strong and full. As much as 300 to 400 c.c. of blood may be removed, and this should be followed by the subcutaneous injection of 500 to 750 c.c. of saline solution. Williams estimates that the withdrawal of 500 c.c. of blood and its replacement by saline solution removes from one-fifth to one-fourth of the total quantity of poison. It has been advised by Jardine to add sodium acetate to the normal saline solution. This is supposed to be beneficial by increasing the alkalinity of the blood.

Elimination from the respiratory tract should be encouraged by arti-

ficial respiration if the respiratory movements are sluggish and shallow. The inhalation of oxygen is also advisable. Artificial respiration may be performed for days at a time at half-hour intervals. It is particularly important to prevent the entrance of foreign bodies into the trachea on account of the danger of inspiration pneumonia, and the patient is kept on her side to facilitate the flow of mucus from the mouth.

The obstetric treatment in cases of eclampsia varies quite as much as the medicinal. The consensus of opinion seems to be that the convulsions should first be controlled and elimination started, and by that time usually there will be sufficient dilatation of the cervix to end labor either by forceps or by version. A useful preliminary measure advocated by Hirst to reduce the blood pressure is puncture of the membranes, and this can be done with little disturbance.

For sudden, overwhelming cases the uterus should be emptied rapidly. Dilatation of the cervix may be secured by appropriate obstetrical measures, which need not be discussed here. It suffices to say that the cervix may be quite rapidly dilated by means of a Pomeroy bag, and the woman delivered by forceps or version, or in certain selected cases the operation of vaginal Cesarean section will offer the best results. In the more slowly developed forms of eclampsia the less aggressive obstetrical methods are to be preferred.

Lumbar puncture, nephrotomy, and decapsulation of the kidneys, all of which have been recommended in the treatment of eclampsia, might do good occasionally, but, as Hirst insists, at the present time there is no well-recognized indication for them, and routinely, they would be more harmful than beneficial.

When the coma is deep and the respirations are superficial, in addition to artificial respiration, Bumm practises cold sponging and slapping (especially over the heart) and heart massage.

The extract of parathyroid glands in the less acute cases may be given in a dose of 1 grain every three or four hours.

My own practice is to control convulsions with chloroform and try to prevent their recurrence by giving veratrum viride and morphine. Croton oil is at once administered, the patient is placed on her side and surrounded with blankets wrung out of hot water, and over them is placed a rubber sheet and dry blankets.

Venesection and the introduction of saline solution under the skin is almost always indicated, the amount of blood withdrawn and the quantity of saline solution introduced depending upon the blood pressure and pulse rate. Usually the patient is bled until the pulse becomes perceptibly softer, or until, in large women, as much as $\text{f}\overline{3}\text{xij}$ to Oj of blood has been withdrawn. An equal quantity or more of saline solution may then be introduced unless the pulse tension remains persistently high (150 to 180), when half the amount is administered.

In cases of great severity, where the coma is deep, I believe in dilating the cervix and vagina with a Pomeroy bag and delivering rapidly by forceps or version, or, if even more speed seems essential, vaginal Cesarean section. In a majority of cases, aside from puncturing the

membranes, the patient is let alone until the os has dilated to the size of a dollar, when it may be further dilated and a forceps operation or version performed.

Mastitis.—The earlier symptoms of mastitis may be almost identical whether it be the simple parenchymatous or the more serious interstitial variety. For this reason, in every case seen early, the assumption should be that the parenchymatous form is to be dealt with and the measures instituted which commonly relieve it. The child should be immediately taken from the affected breast in order to prevent unnecessary traumatism to the nipple, and the milk removed by gentle massage and a breast pump. In applying either, no force or roughness should be used, and the procedure should not cause pain. The nipple may be fissured, and, if so, the fissure should be painted with nitrate of silver (10 per cent.) and covered with a piece of sterile gauze spread with boric acid ointment.

The breast should be bandaged with firm and equal pressure, and, outside of the bandage, an ice cap should be applied. If the cold is not agreeable, loose folds of gauze, moistened with lead water and laudanum, may be wrapped about the breast, covered with waxed paper and a snug bandage. This treatment may be repeated every four to six hours, depending upon the secretory activity of the breast.

If after eighteen to twenty-four hours there is no abatement in the symptoms, or if they become worse, it is usually an evidence that the inflammation is interstitial. Thereafter there should be no massage, compression, or pumping of the affected organ. It should be kept surrounded by hot compresses of lead water and laudanum, and, at the first indication of pus, treated by surgical measures.

Bier's hyperemic method is usually successful in the parenchymatous form of mastitis, and may be employed for twenty-four hours in any early case. If no relief is afforded within that time its further use may be associated with incision of suppurating or indurated areas. The incisions need not be as large as they are made usually, and the use of the suction afterward assists in drainage.

In employing Bier's method it is of considerable importance to select a suction glass sufficiently large so that its rim may rest well outside of the breast tissue. Although the large bell-glass may serve to evacuate the milk, it is a good plan usually to employ a smaller glass previously, which is placed over the nipple and the areola.

When using the large glass cup, the breast turns a dark red and is aspirated into the cup after the air has been sufficiently rarefied. A sensation of gentle tension is permissible, but no pain. The treatment is used for five minutes at a time, with two to three minutes' rest during forty-five minutes a day. In the meantime the organ is gently supported by a dressing.

A majority of cases yield to this treatment within twenty-four hours. Should the symptoms not be abating at that time, or should the condition grow worse, incisions must be employed in connection with the suction. For a detailed description of the treatment the reader is referred to the book of Meyer and Schmieden, Philadelphia and London, 1909.

Puerperal Infection.—At the beginning of a case of puerperal infection it is desirable to make a thorough pelvic examination in order to determine whether there are any gross lesions which account for the temperature and whether any necrotic or septic material is present within the uterus. It is quite unusual at the onset of the symptoms to find evidence of inflammatory disease outside of the uterus, but it is always possible that infected placenta, membranes, or decidua lie within. It is a good plan, therefore, in every case after disinfecting the vagina and perineum with green soap and sterile water, followed with bichloride (1 to 2000) solution, to gently dilate the cervix and explore the uterine cavity with the finger and placental forceps, removing secundines which remain and washing out the uterine cavity with sterile salt solution. The curette should not be used, for it is capable of more harm than good. It may break down a protecting layer of leukocytes beneath the endometrium and spread the infection to the deeper parts.

Under certain circumstances this plan may not be necessary—for example, if the symptoms have started late in the puerperium, if the uterus has undergone satisfactory involution, if there is no discharge, if the cervix is closed, and especially if there are other lesions outside of the uterus which account for the septic symptoms.

Intra-uterine douches are of little service except for the purpose of keeping the cervical canal patulous and preventing an accumulation of lochial discharge. If the endometrium is infected it is probable that the organisms have penetrated to such a distance by the time the symptoms have appeared that no antiseptic intra-uterine irrigation would have any effect upon them.

Nevertheless, if the intra-uterine douche is given skilfully and with strict attention to an aseptic technique the use of such solutions as 5 per cent. argyrol, the tincture of iodine (1 per cent.), in equal parts of alcohol and water, formalin (0.05 per cent.) in glycerin and water, or 50 per cent. alcohol, during the first few days, can do no harm and may sometimes be beneficial.

The Carosa treatment consists of passing a soft rubber catheter to the fundus and packing gauze around it, loosely filling the uterus. One to two drams of 50 to 75 per cent. alcohol is injected through the catheter every twenty to thirty minutes for forty-eight hours. As the temperature comes down the frequency of the injections may be diminished, and if the temperature continues to rise under this treatment it should be discontinued.

Edgar packs the uterus with gauze soaked in a 50 per cent. ichthyol solution. Fabre uses for intra-uterine irrigations an emulsion of 4 ounces of the oil of turpentine, 4 ounces of alcohol, and 1 quart of water.

It is important not to overlook localized lesions of the vulva and vagina before proceeding with intra-uterine examination, otherwise a healthy uterus may be infected. Any lesions, therefore, in the vagina or vulva should be carefully touched with pure phenol or a strong solution of silver (20 per cent.) before proceeding with the examination.

After the question of septic absorption from the interior of the uterus

has been settled every effort should be bent toward increasing the resisting powers of the patient. Milk, broths, koumiss, eggs beaten up in milk, malted milk, predigested beef, liquid peptonoids, panopeptone, or any nourishing and easily assimilated food should be given at frequent intervals, and in as large a quantity as the stomach will bear. Plenty of water should be drunk in order to stimulate the kidneys, and perspiration should be encouraged. The bowels should be opened freely with divided doses of calomel, followed by Epsom salt. If there is diarrhea a full dose of castor oil may be prescribed, followed by enough bismuth subgallate to prevent exhaustion, but not enough to check the bowels, for the diarrhea may be an effort at elimination.

Stimulants are required in most cases. They should be prescribed as needed, the dose being gradually increased. Those most commonly used are strychnine ($\frac{1}{80}$ to $\frac{1}{30}$, every six to three hours) and whisky (f3ij to f3j, every four to two hours), or some form of alcohol. Tincture of digitalis (mxxv to xxv, every six to three hours) and camphor (gr. j to ol. olivæ, mxx every four to two hours) hypodermically should be used for extreme cases. Care should be observed to give these drugs in such a form that they interfere as little as possible with the stomach. In desperate cases the hypodermic method is best. No phenacetin or other coal-tar products should be employed to control temperature, although moderate doses of quinine (gr. ij to iv, every six to three hours) may be used for this purpose. The administration of ergot (fl. ext., 3j, or ergotin [Bonjean's], gr. ij, every three hours) is sometimes judicious, because it helps to contract the uterus and expel clots or putrid lochial discharge, from which absorption might occur. The subcutaneous administration or the rectal infusion of normal salt solution ($\frac{1}{2}$ liter every three hours) is an aid to diuresis and diaphoresis.

Besides fortifying the patient to resist infection by concentrated nourishment and drugs, certain other measures have been advocated from time to time which destroy the organisms or their toxins directly.

The use of antistreptococcic serum has been more or less disappointing. A few years ago an investigation of the results of the use of the serum showed that more deaths occurred in those cases treated with the serum than in those treated without it. Nevertheless, at the present time in bad cases it is desirable to use a polyvalent antistreptococcic serum, but it should be given in large dose. One should begin with at least 80 c.c. and this should be repeated every six hours until 320 c.c. have been injected within twenty-four hours. As a rule, antistreptococcic serum should not be used unless the organism has been found in the uterus or in the blood. In desperate cases one need not wait for such an examination.

It has been advised to introduce certain antiseptics into the circulation. The only one, however, which deserves serious consideration is colloidal silver (collargol). This may be employed in a 1 per cent. solution, as much as 0.06 to 0.10 gm. (0.9 to 1.5 gr.) being injected at a dose into the saphenous vein. The vessel may be exposed by an incision (2 to 3 cm. long) over the internal malleolus. The vein should be ligated

twice, and the incision should be closed after the injection. This is the practice of Caelic and Dimitriu, who say that in many cases, four or five hours after the injection, there may be a slight rise of temperature, sometimes preceded by shivering; but the fever does not last long, and is really a good sign. Credé's ointment may be tried (gr. xv to xlv), being well rubbed (fifteen to twenty minutes) into the skin of the thighs or loins, twice daily.

Nuclein may be used for the purpose of increasing the white blood corpuscles of the blood and favoring phagocytosis. Nuclein may be obtained in a 5 to 10 per cent. solution, of which the dose is 10 to 60 minims, hypodermically.

"Bacterial inoculations," according to Benjamin A. Thomas, "seem destined to play an important role in the treatment of puerperal sepsis. It should be remembered, primarily, however, that bacterin therapy is merely a valuable accessory, not a measure to be used alone. Furthermore, the therapist must definitely determine at the outset whether the infection remains localized to the pelvic content or has become complicated by a bacteriemia. Bacterins should be employed solely in the former condition; in the latter their use is positively contraindicated, as in septicemia, pyemia, and grave sapremia generally.

"By virtue of the diversity of the streptococcus, the commonly infecting organism, an autogenous bacterin should routinely be employed. Exceptionally, and as an initial inoculation, a stock preparation may be utilized. The procedure should be, first of all, to culture the blood. If this is found to be sterile a uterine culture is made and an autogenous bacterin prepared from the isolated bacterium.

"The inoculations, as a rule, may be satisfactorily governed by a careful observance of the clinical symptomatology, although puerperal sepsis is a disease in which the best results are to be obtained by the association of the opsonic index as a guide. The dosage should be 10,000,000 to 50,000,000 dead bacteria."

As a rule, operative treatment is not indicated in cases of puerperal sepsis until there is a well-defined gross lesion in the pelvis, or until, from the persistence of the symptoms, it is almost certain that the uterine body itself is so diseased that its removal is the only hope of controlling them.

The symptoms of general peritonitis also may call for a hasty laparotomy.

Pyelitis.—The patient should be put to bed and placed upon a liquid diet. A capsule of sodium benzoate and urotropin (āā gr. v) should be given with a glass of water every three hours. The knee-chest position should be assumed for five minutes at a time, every three hours, unless the size of the abdominal enlargement renders this impracticable, and in the meantime the patient should lie in the Sims position, on the unaffected side. Heroin or codeine may be required to quiet the pain.

If this plan of treatment does not relieve the symptoms, and especially if urinalysis shows increasing pus, albumin, or casts, pregnancy should

be terminated. Nephrotomy has been suggested, but is certainly not to be seriously considered unless the symptoms persist in spite of interruption of pregnancy.

If a patient who has had this complication in a previous pregnancy comes under observation early in gestation she should be urged to take the knee-chest position twice a day, practice sleeping in the Sims position, drink plenty of water between meals, and have an examination of the urine at frequent intervals. If the kidney is unusually movable it should be supported by an abdominal binder and kidney pad.

Toxemia of Pregnancy.—To discuss the treatment of the toxemia of pregnancy intelligently it is necessary to state that there is a tendency at the present time to group under this title many of the disorders peculiar to pregnancy—such as persistent nausea and vomiting, the so-called kidney insufficiency, acute yellow atrophy of the liver, and eclampsia. Whether they are really manifestations of a common underlying cause no one can say with certainty, and there have been many arguments for and against this teaching.

It appears likely that there is an etiological difference between the pernicious nausea of early pregnancy and the kidney breakdown, or eclampsia of the later months.

During early pregnancy the uterine wall is invaded by the earliest cells of what subsequently forms the placenta. These cells collectively are spoken of as the syncytium, and their proliferation and deportation into the blood is supposed to result in the production of an antibody, syncytiolysin which checks their growth and keeps their activity within physiological limits. The production of syncytiolysin is possibly the reason for toxic symptoms during the earlier months, and the chief of the toxic symptoms is exaggerated vomiting.

The toxemia of the second half of pregnancy is supposed to be due to a failure of the maternal organism to excrete both its own and the waste products of the fetus. The waste products are disposed of partly by the liver, being broken up by oxidation into substances which can be eliminated, the process of elimination being carried on by the kidneys. It is evident that if either the kidneys or the liver are insufficient there will be an accumulation of toxins in the blood.

If these ideas are correct, and they accord more fully with clinical facts than any other theories, it is at once evident that little can be done to prevent the nausea of pregnancy; one can only endeavor, by measures which will be detailed later, to prevent it from becoming exaggerated and uncontrollable. It is always an uncertain quantity, and frequently is quite beyond any control, unless it be by terminating pregnancy.

Quite the contrary is true of the toxemias which mark the later periods of pregnancy, for as they are the result of a deficient excretion of waste products the indications of faulty metabolism may be watched for, and, if they appear, steps taken to assist the emunctories to perform their functions properly.

The prophylactic treatment, therefore, of nephritic and hepatic insufficiency, preëclamptic toxemia, and eclampsia is of great importance.

There are certain danger signals, and these ever must be kept in mind, and at their first appearance, actively combated.

The metabolic disorders which lead to the toxemia of later pregnancy involve chiefly the kidneys and liver, but indirectly also the ductless glands, the intestines, and the nervous and the circulatory systems, with all of which, as a consequence, the prophylactic treatment as well as the curative has to do.

Although in recent years it has been recognized that the kidneys are less frequently solely at fault, and that their activity and the quantity and chemical composition of their excretory product may be indicative of serious primary disturbance elsewhere, nevertheless, to the practising physician urinalysis offers the best index of approaching danger. For that reason the urine should be examined monthly during early pregnancy, and if any abnormality appears it should be examined every week or two, or every day, according to the gravity of the case. The quantity, chemical composition, and histological constituents of the urine indicate the anatomical and functional health of the kidneys and the rate at which the economy is getting rid of waste products.

The specific gravity gives a fair idea of the total solids excreted, but a more important fact to determine is the amount of nitrogenous substances. The simplest index of this is the percentage of urea which can be determined by an easy method (Doremus'). Unfortunately in disturbed metabolism the nitrogen is not eliminated as urea alone but as other substances—ammonia, kreatinin, and the amido acids—which to simple tests give the same reaction as urea and may lead to an erroneous estimate of the urea output. They indicate serious errors in metabolism, and their detection, which is possible by more elaborate tests, is highly important, but quite beyond the average doctor.

Unless a chemist is available the practising physician will be compelled to rely on the specific gravity, the usual tests for albumin, sugar, indican, and urea, and the microscopic examination for casts. The best test for albumin is boiling and the addition of acetic acid. The simplest plan for the estimation of urea is that of Doremus. The total amount of albumin may be determined most conveniently by using Esbach's albuminometer.

Hepatic insufficiency has recently received a considerable amount of attention. The function of the liver is so closely associated with that of the kidney that most of the urinary tests apply to both organs. Hepatic insufficiency may be indicated by changes in the total nitrogen, urea, nitrogen partition, glycosuria, etc. The history of bilious attacks in the patient and an hereditary predisposition to liver trouble should receive attention. The liver may be examined for enlargement or tenderness; the skin, for a yellowish tinge.

The thyroid gland normally hypertrophies during pregnancy and is said to play an important part in the increased metabolic activities which have to do with the elimination of waste products. A failure of the gland to develop, or a diseased condition of the gland, as in Graves' disease, should be regarded as predisposing to toxemia.

The pulse tension may afford the first indication of toxemia; during pregnancy this ranges normally between 110 and 140. Above 150 it is ominous, and if it rises to 180 and there are some of the other indications of toxemia, pregnancy should be interrupted.

An abnormal state of the nervous system, according to Davis, is one of the most important evidences of toxemia; neuralgic pain, hebetude, anorexia, exaggerated reflexes, epigastric crises, etc., should be regarded as possible precursors of a toxemic attack. Substernal and epigastric pain often are symptoms of significance.

An examination of the eye-grounds may be of great value in any case of suspected toxemia, with or without optical symptoms. The indications of toxemia due to kidney or liver insufficiency may be found in the eye before there are any manifestations of it in the urine.

I have mentioned the indications of toxemia at such length because it is only by being thoroughly familiar with them that the doctor is able to protect his patient promptly by appropriate measures if the occasion arises. The prophylactic treatment is based on careful and continuous observation of the patient throughout pregnancy. At the outset the pregnant woman should be given a full physical examination, including blood pressure, urine analysis, red and white blood counts, and hemoglobin estimation.

The history of previous indigestion, constipation, headache, and visual disturbances should be carefully noted. A pelvic examination should be made to see that the pregnancy is intra-uterine and that the uterus is in good position.

The diet should consist largely of fresh vegetables, cereals, fish, and fruit. Meat should be limited, and whatever common sense or experience teaches may be indigestible should be avoided. To prevent over-eating, milk may be taken several times a day between meals. The patient should be warned especially against overloading the stomach. Water should be taken freely two hours after meals, and frequent exercise practised in the open air. If the bowels move well every day, no special cathartic will be required. In the later months of pregnancy, constipation is almost universal. I then prescribe regularly the following pill:

R—Cascarin (Merck)	gr. $\frac{1}{4}$
Aloini	gr. $\frac{1}{4}$
Podophylli	gr. $\frac{1}{8}$
Ext. belladonnæ fol.	gr. $\frac{1}{8}$
Strychninæ sulphatis	gr. $\frac{1}{16}$
Oleores. zingiberis	gr. $\frac{1}{16}$

One or two at night, and vary this once a month with a formula suggested by Richard Norris:

R—Podophylli	gr. j
Pulv. ipecacuanhæ	gr. ij
Hydrargyri chloridi mit.,	
Euonymi	āā gr. iiij
Phenolphthalein	gr. xxiv

M. et div. in pil. no. xxiv.

Sig.—One every night for a week.

The urine must be examined at least once a month. The patient is directed to report promptly, persistent headache, epigastric pain, swelling of the ankles, disturbance of vision, or any other symptoms which appear unusual. Later in pregnancy, after the sixth month, in connection with the usual obstetrical examination, the pulse rate and the blood pressure should be estimated about once a month.

If in spite of this care symptoms arise which indicate a beginning toxemia, steps must be taken to meet them. If the urine shows albumin, Basham's mixture is prescribed, the ingestion of water is increased, and meat is excluded from the diet. If the symptoms are referable more to the intestinal tract or liver, calomel is given in divided doses, followed by salines and gastric and colonic irrigation, with infusions of saline solution into the bowel.

The urine, reflexes, blood pressure, etc., should now be examined more frequently than before. If the symptoms become more marked, if more albumin and if casts make their appearance, if the blood pressure rises, or any other symptoms increase in intensity, the diet should be reduced to milk, fruit, green vegetables, and fish. The measures previously described should be repeated more frequently, and diuretics, such as potassium citrate or potassium bitartrate (gr. x to xxx, every three hours), should be administered until free diuresis and purgation occurs. A hot vapor bath should be taken daily or oftener as long as the symptoms persist, and it may be necessary from the first to have the patient remain in bed.

Thyroid extract should be tried for these patients in whom the gland has not undergone the usual hypertrophy or is evidently diseased. The hypodermic administration of a saline extract of thyroid proteids (thyreoglobulin), made from fresh human glands (m_v, b. i. d., to m_x, t. i. d.), is said to be superior to the ordinary thyroid extract. The dose of the ordinary extract is gr. j, t. i. d.

The urine should be examined every day and a record made of the total amount of albumin, by Esbach's or Purdy's method. The best test is Purdy's. The amount of urea should be determined from time to time, although without estimating its ammonia co-efficient, the result may be misleading. The proportion of urea depends upon the diet and upon the activity of the other emunctories (bowels and skin). It is always subnormal when the patient is living on milk. The amount varies widely, apparently, even in health. Because the ammonia partition reacts to the same test a woman with an apparently high output of urea may in reality be excreting very little urea, and display a rapidly progressing toxemia, with increasing albuminuria. In a majority of cases, however, the Doremus estimation will be a reliable index of the nitrogen excretion and combined with the clinical indication, is of value.

If in spite of this treatment the unfavorable symptoms persist the patient should be actively purged with Epsom salt, and a hot vapor bath or a hot pack should be given every four hours following the injection of a pint of salt solution under the skin. In women near term this plan usually brings on labor; if it does not do so within forty-eight hours,

unless the symptoms have rapidly ameliorated, labor should be induced with bougies or bags.

A marked and sudden increase in albumin, high blood pressure above 180, and disturbance of vision call for the immediate induction of labor, as well as the eliminative treatment which has been described under eclampsia.

Pernicious Vomiting.—The usual treatment of a case of pernicious vomiting in pregnancy is as follows: The patient should take a light breakfast before rising from bed and while she is flat on her back, and after eating she should rest for at least a half-hour. A half-hour before her other meals she should have a cup of hot water, flavored with enough salt to make it palatable, and sip it slowly. This should be followed by a capsule of *nux vomica* (gr. $\frac{1}{3}$), and soda bicarbonate (gr. x).

The diet should be an ordinary one, with articles of food which the patient feels or knows will not agree with her, left out; but the appetite, if there is any, should be gratified within reason. If the patient desires no food a little may be urged upon her, but she should not be asked to take very much. After eating, a capsule of cerium oxalate (gr. ij), cocaine (gr. $\frac{1}{12}$), and codeine (gr. $\frac{1}{8}$) should be given. A careful examination should be made of the pelvic organs, and any abnormalities corrected. Sexual relations should be prohibited.

If this treatment does not relieve the symptoms, or at least hold them in abeyance, the patient should remain in bed. If the stomach is exceedingly acid it should be washed out with a weak solution of bicarbonate of soda, and after meals, the following capsule exhibited:

R—Magnesiæ ustæ	gr. v
P. carb. lig.	gr. j
Bismuthi subcarbonatis	gr. j
Resorcini,	
Ext. hyoscyami	āā gr. $\frac{1}{2}$

Bromides (gr. x to xxx) and chloral (gr. v to xv) may be given by the rectum or in capsule. As a sedative, Baisch recommends scopolamin very highly. If the patient is restless at night it may be necessary at times to give a hypodermic of morphine. In case the symptoms persist, food by the mouth should be withheld, and warm saline infusions given by the rectum (1 pint every three hours). Nutrient enemas may be employed, although I question whether they have any advantage over saline infusions. The following formulas are useful:

One cup of milk,
Three drams of dry peptone,
Yolk of one egg,
Five drops of laudanum.—(Norris.)

Milk, 135 c.c.,
Two eggs.
Digest the above with pancreatin, and add sufficient salt to make the saline content equal to normal salt solution.
Laudanum, three drops.—(Edsall.)

Other measures which may be tried to relieve the nausea are spraying the fauces with cocaine, the use of faradism over the neck and epigas-

trium, a mustard plaster over the epigastrium, and the following drugs: Tr. iodine (gtt. j to ij), antipyrin (gr. j to iij), wine of ipecac (m v to x).

While these measures are being tried, elimination should be furthered by giving calomel in divided doses followed by salines. Certain gynecological treatment is sometimes of service, such as scarification of the cervix or the application of cocaine to the cervix. Sometimes dilating the internal os with a glove-stretcher dilator, or the finger, taking care to avoid rupture of the membranes, is effectual.

De Lee, in bad cases, advises Bier's treatment applied to the cervix before any dilatation is attempted. Williams believes that by examining the urine and determining the proportion of the ammonia nitrogen, a sharp line may be drawn between those forms of pernicious vomiting, spoken of as reflex or neurotic, which yield to treatment, and those forms spoken of as the toxemic, which do not yield and in which labor must be induced. The general opinion, however, is not in accord with Williams, and an increase in the ammonia nitrogen is regarded merely as an indication of serious errors of metabolism and of the degree of starvation.

A strong mental impression may sometimes cause the nausea to stop. The administration of a certain drug, with the positive assurance that it will cure, the decision to empty the uterus, and a description of the method to the patient may be successful. The induction of abortion should not be deferred too long. If there has been a steady rise in the ammonia nitrogen, and progressive starvation, the uterus should be emptied. If, as Norris declares, after seven to ten days of treatment all food and drink are continuously rejected; if nausea is provoked by the odor or merely the sight of food, or by a change in position; if there is progressive weakness and exhaustion, intense thirst, epigastric pain, and tenderness, constipation and a coated tongue, pregnancy should be interrupted.

PART VIII

TREATMENT OF DISEASES OF THE SKIN

By HOWARD FOX, M.D.

WHILE the great majority of diseases of the skin require treatment by local measures, it is undeniable that in many cases the combination of both general and local therapy is necessary to effect a cure. Attention has been called to the fact that certain American dermatologists who formerly studied under Hebra, a great advocate of local treatment, have found as a result of subsequent experience that the best results are to be obtained by a rational combination of both general and local measures. In association with my father, a former pupil of Hebra, it has been my privilege to see the truth of this statement, and to become convinced of the absolute value of general therapeutic measures in the treatment of many skin diseases.

In treating a patient suffering from a skin disease (other than those of purely local origin) it is important that he be placed in the best possible physical condition. The patient should, in other words, "go into training," as far as this is possible, without causing him too great inconvenience. As many patients consider themselves, and in fact appear to be, in good health it is difficult to convince them that their general condition could and should be still further improved. When this is done, many cases of skin diseases which have long proved obstinate to local treatment will then disappear, with surprising rapidity, under almost any simple remedy.

Of all the general measures to be considered the most important, it seems to me, are (1) those which concern the diet and the regulation of indigestion and constipation, and (2) systematic exercise. In regard to diet it may be said in general that too much nitrogenous food as a rule is consumed. Meat should not be eaten more than once a day, and in many cases it is well to stop its use for several days or weeks. This applies as well to the use of soups that are made from meat. A strict fruit and vegetable diet, especially at the season when fresh green vegetables are obtainable, will often bring about a surprising improvement in cases of inflammatory skin diseases. Fats and carbohydrates can be taken in proper proportion. Highly seasoned and indigestible food should naturally be avoided. It is only in the strictest dietary that I would exclude fresh fish. As a matter of fact the most rigid diet of milk with crackers or bread for a few days will often be of great value in eczema or urticaria. Certain articles of food to which an idiosyncrasy is shown should naturally be carefully avoided. Fully as important as

the variety of food is the amount which is consumed. The average patient, in spite of frequent protestations of "eating very little," can maintain his normal weight by eating a considerably smaller amount of food than that to which he is accustomed. Furthermore, it is of the greatest importance to correct the habit so prevalent in American cities of eating rapidly.

Alcohol should be prohibited in acute inflammatory diseases of the skin, especially those of the face, as its ingestion causes a dilatation of the arterioles of the skin. As it also tends to increase pruritus, it should be avoided, or sparingly used, in the itching dermatoses. In other conditions, especially in old people, it may prove a valuable tonic and digestive aid. It is advisable to limit the use of coffee to one or two cups at breakfast, when its slight laxative action is of value. Tea, I think, is better avoided altogether. Many cases of rosacea in women are greatly aggravated, if not largely caused, by excessive tea drinking. The use of tobacco is entirely harmless, as a rule, except in the case of an extremely nervous patient or where lesions of the mouth, such as mucous patches or leucoplakia, are present. Cases are recorded, however, in which obstinate itching such as pruritus ani has been relieved by the discontinuance of smoking.

As so many cases of inflammatory skin disease are associated with digestive disturbances it is of the greatest importance that the latter should receive appropriate treatment. Constipation should be remedied by salines, mercurials, cascara, etc. Indeed, it is often advisable, even if there is no constipation, to induce a rather free action of the bowels, which will tend to relieve congestion of the skin as well as to remove sources of auto-intoxication.

A therapeutic measure of importance, too often ordered in a perfunctory manner, is daily systematic exercise. While the opposite plan of treatment, namely, rest in bed, is suitable for some acute and extensive cases of skin disease the rule holds good that in most cases the patient should be strongly urged to take daily exercise with unfailing regularity.

Water is a general remedy of considerable value, and should be taken between meals in amounts varying from eight to ten glasses a day. That the various natural mineral waters have any particular advantage over good, pure spring water appears to me very doubtful. I agree with Pusey, that "the claims of remarkable specific virtues in various skin diseases which are made for natural mineral waters, particularly as they are used at their springs, are greatly exaggerated." The benefit that may result from a visit to some mineral spring is due, it seems to me, to improved hygiene, mental rest, change of climate and scene, etc.

The effect of the climate upon certain diseases of the skin is at times of therapeutic importance. There can be no question that some cases of pernio, Raynaud's disease, pityriasis rubra, and recurring eczema of the face are benefited by a residence in a mild climate during the winter months. Cases of lupus and scrofuloderma are benefited by sea air, while, on the other hand, a dry, inland climate seems best suited for patients suffering from eczema.

The ability of the skin to supplement the action of the diseased kidney is well shown by the immense value of hot packs in nephritis. The ability, on the other hand, of an increased action of the kidney to aid the diseased skin is much less marked. The action of diuretics in cases of inflammatory skin disease is, nevertheless, at times of value. The acetate or citrate of potash are probably the most valuable drugs that can be used for the purpose. The drinking of large quantities of water may also prove of value, as has been said, from its diuretic action.

With the exception of certain severe cases of herpes zoster, there is seldom any occasion for the use of analgesics in dermatology. Itching rather than pain is the subjective symptom that most frequently accompanies diseases of the skin. Unfortunately, there is no internal remedy of any real value that will control this frequent and important symptom.

The employment of internal remedies for their specific effects upon diseases of the skin will generally lead to disappointment. In dermatology, as in general medicine, there are very few specific remedies. There are certainly none whose action can be even compared with that of mercury in the treatment of syphilis.

From its undoubted effects upon certain forms of skin disease, *arsenic* must be considered as a drug of considerable importance. It is a remedy that has been used too freely in former times, and one that is apt to be employed by the general practitioner as a panacea for all cutaneous diseases. For this reason it is possible that it is used too little by dermatologists at the present time. It is probable that some of the poor results ascribed to arsenic are due to failure to continue its administration for a long enough period. Considerable patience must be shown in using the drug, and no improvement can be hoped for until one to three months have elapsed. At times it is necessary to wait even longer. Arsenic is unquestionably a valuable general tonic, its administration causing an increase in the hemoglobin index, an improvement in appetite, and a general increase in weight. Its value in dermatology is, however, chiefly due to its selective action upon the epithelial layers of the skin. It acts either directly or through the terminal nerves as a stimulant, and is consequently useful in chronic sluggish inflammatory diseases of the skin involving chiefly the epidermis. Its indications are to be found in psoriasis, chronic thickened scaly eczema, lichen planus, certain dystrophies of the nails, etc. Pusey compares its action to a local stimulant or reducing agent, such as tar, the indications and contraindications of the two remedies being similar. Certain it is that arsenic is absolutely contraindicated in the acute inflammatory stage of psoriasis. It is only in the quiescent chronic stage that it should be employed. The action of arsenic as a nerve tonic may explain the beneficial results that have followed its use in cases of pemphigus, Duhring's disease, and pompholyx. For some unknown reason its employment has also been productive of more or less benefit in certain cases of sarcoma, and even carcinoma.

In administering arsenic it is always advisable to begin with a small dose on account of a possible idiosyncrasy. It should then be given in

steadily increasing amounts up to a certain maximum, and again gradually decreased to the original dose. Arsenic should never be prescribed unless the patient is under the more or less constant supervision of the physician. At the first appearance of toxic symptoms the dose should be reduced and increased later if necessary. In no case should treatment be abruptly ended. Symptoms which would point to an intoxication from arsenic are puffiness about the eyes, injection of the conjunctivæ, headache, nausea, gastric pain, diarrhea, and in severe cases mild jaundice and painful urination.

Various forms of chronic poisoning, fortunately of rare occurrence, may at times result from the prolonged administration of arsenic. This may take the form of keratoses of the palms and soles, which are very difficult to cure, and tend to recur rapidly after removal. They become at times the starting point for epithelioma. Arsenical poisoning may also take the form of either a macular, irregular patchy, or diffuse brownish pigmentation, which is extremely persistent and at times permanent. It may also take the form of a vesicular eruption, resembling herpes zoster, when the lesions are grouped, or a pemphigus, when the lesions are irregularly scattered. Finally multiple neuritis and atrophy of the optic nerve should be mentioned as possible results of chronic arsenic poisoning.

Arsenic may be administered in solution, in pill form, or by means of hypodermic injections. Probably the best fluid preparation is the well-known solution of potassium arsenite (Fowler's solution). For administration in tablet or pill form the arsenous acid is convenient. The most active method of giving the drug is by hypodermic injection, in which case it is advisable to use a solution of sodium arsenate. Other preparations, such as arsenate of iron, iodide of arsenic, and sodium cacodylate, are doubtless good, but have not proved their superiority over the first three that were mentioned. Atoxyl is without doubt an arsenical compound of powerful action, though not entirely devoid of danger, its administration having been followed in certain cases by optic nerve atrophy. The compounds of arsenic emanating from Ehrlich's laboratory, and known popularly as soamin, arsacetine, and "606," have only been used, to my knowledge, in the treatment of syphilis, and will, therefore, not be discussed in this section.

The specific action of *mercury and the iodides* is not limited to their action in syphilitic manifestations. Mercury, for instance, may be used with advantage in certain chronic inflammatory diseases of the skin, in conditions where arsenic is indicated. The results obtained by its use in lichen planus are at times surprisingly good. Indeed, at the present time it is frequently used as a routine method in the treatment of this disease. Iodide of potash (or iodide of soda) is of great value in cases of blastomycetic dermatitis and in actinomycosis. It should be given in large doses, as in the treatment of gummata. Good results have also been claimed for its use in psoriasis. It has, I think, been used too freely in psoriasis and other dermatoses, just as I believe it is too frequently administered in cases of syphilis where mercury is indicated.

In the treatment of *leprosy* there are two drugs, *strychnine* and *chaulmoogra oil*, whose internal administration is generally followed by beneficial results. The value of *chaulmoogra oil* is such as to merit its being classed among the drugs having a true specific action.

In recurring eruptions, such as erythema or urticaria associated with malaria, the action of *quinine* is specific. It is also of value at times in diseases of the skin due to nervous origin such as pemphigus, Duhring's disease, chronic urticaria, and especially herpes zoster accompanied by severe neuralgia. Good results have also been reported from its employment in the superficial wandering type of lupus erythematosus.

Salicin has been recommended by Crocker for psoriasis and other conditions in which arsenic is indicated. He finds that it often succeeds where arsenic fails, as, for instance, in a spreading psoriasis. It is necessary, according to Crocker, to give the drug in large doses, not less than 15 grains. Its administration at times may be followed by indigestion. *Salicin* or *salicylate of soda* are regarded by Norman Walker as almost specific in the treatment of erythema nodosum. *Salicylate of soda* has also been found of value in cases of urticaria and general pruritus.

Sulphur is unquestionably one of our most valuable remedies in the external treatment of various dermatoses, especially disorders of the sebaceous glands. Its internal administration has also been freely recommended for the same purpose. With the exception, however, of a cathartic action it does not seem that the internal exhibition of the drug is productive of any particular results. Sulphur in the form of calcium sulphide has been strongly recommended in furunculosis, and has shared with yeast the reputation of being almost a specific for boils. I have never been able to see, however, that calcium sulphide produced the slightest effect in furunculosis.

Ichthyol is frequently administered, with the idea of producing vasoconstriction in cases of acne vulgaris, rosacea, and lupus erythematosus. That ichthyol will reduce hyperemia when locally applied is shown by its splendid effect in erysipelas. That it can also reduce cutaneous hyperemia when given internally is somewhat doubtful. Ichthyol is also given in leprosy, and is thought by some to be almost specific in this disease.

Ergot is also employed at times for its supposed vasoconstrictor action in erythema, urticaria, and purpura. In the treatment of purpura it is often combined with iron. It is, I think, of rather doubtful value.

From its powerful action in stimulating the production of sweat it might be supposed that *pilocarpin* was a valuable remedy in dermatology. Such is unfortunately not the case. It is true that in dry, scaly conditions, such as ichthyosis or even psoriasis, it may at times be used with advantage. It has also been found to control itching in certain generalized conditions, such as urticaria, eczema, and pruritus. The claims made for *pilocarpin* in the treatment of alopecia have not been substantiated. Finally, it should not be forgotten that the administration of the drug requires considerable caution.

Atropine, from its ability to lessen an excessive secretion of sweat, is of value in general hyperidrosis occurring in pulmonary tuberculosis. The indications for the use of atropine in dermatology are, however, rather limited. It is said to have a sedative action in urticaria and in pruritus, and has been given in cases of stomatitis for the purpose of lessening the flow of saliva.

Thiosinamin was first introduced by Hans v. Hebra for the treatment of lupus vulgaris. When injected hypodermically it possesses to a certain degree the power of dissolving fibrous tissue. It has been used in the treatment of keloid, hypertrophic scars, scleroderma, and elephantiasis. Improvement is noticed in some cases, while the result in others is a conspicuous failure.

The extraordinary action of *thyroid extract* in myxedema gave rise at first to hopes that not only thyroid but other glandular extracts might play an important role in our therapeutics. While these hopes have not been realized it must be said that at times thyroid extract does appear to be of benefit in scleroderma, ichthyosis, and possibly psoriasis. As the action of the drug may be accompanied by disagreeable symptoms of thyroidism, and as its results are at best rather meagre, its place in dermatological therapeutics is not one of great importance.

Suprarenal extract, which has proved of some value in Addison's disease, has also been tried in cases of vitiligo, without any apparent benefit. The same may be said of ovarian extracts that have been recommended for cases of eczema occurring at the menopause and for testicular extracts in acne for the supposed relationship of this disease to sexual disturbances.

Antimony has been recommended by Sir Malcolm Morris for acute inflammatory conditions, the opposite of those for which arsenic is indicated. It is a drug, however, whose administration requires considerable circumspection. Phosphorus has a similar action to that of arsenic, but is a disagreeable drug to administer. It has been chiefly used in England. Among other remedies that have been recommended by different observers for internal use in the treatment of skin diseases may be mentioned turpentine, tar, carbolic acid, resorcin, creosote, guaiacol, and chrysarobin. Their value, in my opinion, hardly merits their enumeration.

A discussion of the internal remedies employed in the treatment of skin diseases would not be complete without a reference to *vaccine therapy*. Nothing more than a brief mention of this new and promising method of combating disease is here possible, as the subject is fully considered in another section. It may, however, be said that vaccines in the treatment of certain affections of the skin, such as furunculosis, have produced such brilliant results as to entitle them to be classed in the list of specific remedies.

In studying the action of local remedies upon the skin it is convenient, following Jessner, to consider first the effects of dosage. Certain dermatological remedies when used in varying concentration show qualitative differences or even act in a totally opposite manner. For example,

salicylic acid in a 1 or 2 per cent. concentration has a keratoplastic action, and is suitable for use in subacute eczemas. The action, however, of a 10 per cent. ointment is directly opposite—namely, strongly keratolytic and suitable for the treatment of thickened horny growths. The activity of any given remedy will vary greatly, according to its mode of application. Thus a certain drug in the form of a lotion or powder will not be as active as if applied in the form of an ointment or plaster. A salve will, furthermore, be less active if smeared upon the skin than if rubbed in by vigorous friction. The condition of the patient's skin must be considered in judging of the action of dermatological remedies. A concentration that will be too strong for a weeping denuded surface will be weak for a chronically thickened integument. Finally, the patient's individual reaction to the remedy must be considered, as certain persons show a marked idiosyncrasy toward certain irritants.

In the present chapter it will be my object to discuss briefly the local remedies which in my opinion are of the greatest value, and especially those with which I have had personal experience. I shall try to group them according to their various modes of application in dermatology. In the latter portion of the chapter a discussion of the treatment of individual diseases will require the addition of a moderate number of formulæ. I feel, however, that it is of much greater importance to thoroughly understand the general indications of our remedies rather than to try to learn a special prescription often of the "shotgun" variety for each special disease. Space will only permit a discussion of the commoner diseases of the skin.

THE MORE IMPORTANT LOCAL REMEDIES.

Protective and Soothing Remedies.—Many diseases of the skin can be cured by simply affording protection against external irritants, such as cold, the sun's rays, and various forms of traumatism. The application of simple dusting powders, bland ointments, pastes, or fixed dressings are frequently curative from the protection which they offer even when they contain no active medicinal ingredients. Protection from the cold is afforded by clothing that keeps a warm layer of air in contact with the skin. To guard against the actinic rays of the sun it is necessary to interpose a substance that can absorb the violet or chemically active rays. This may be accomplished by wearing a brown veil or by applying a salve or varnish colored by red bolus or ichthyol. For the protection of the hands of *x*-ray workers (who are also exposed to actinic rays), Unna has recommended the use of a glycogelatin colored by 10 per cent. cinnabar. Irritation resulting from friction or pressure of the clothing is often relieved by a bland powder, ointment, or glycogelatin. In a similar manner the friction of opposing surfaces of the body may be relieved. In addition, suspensory bandages for the breast and for the scrotum are often of value. To protect the hands of those whose occupation brings them into frequent contact with acids or alkalis it is

necessary to use a liberal amount of the more solid fats, such as lanolin and wax. Protection against acrid discharges from the various mucous surfaces is afforded by the application of salves or pastes. Other soothing remedies include evaporating mixtures, "cooling salves," the milder astringents, especially aluminum acetate, and the antipruritic drugs in general.

Among the various remedies that have a soothing effect upon diseases of the skin the oxide of zinc certainly stands without a rival. It has been called the "morphine of the skin," and its universal employment in powders, lotions, ointment, pastes, and fixed dressings is entirely justified. Boric acid is also very valuable on account of its soothing properties, and is in constant use as a powder, lotion, or ointment. Its reputed antiseptic power is, however, rather feeble.

Detergents.—The action of water, especially when used with soap, is an invaluable detergent. As, however, it possesses other useful qualities its general action will be considered at this point for the sake of avoiding repetition. The action of water upon the skin is both chemical and physical. Chemically it acts as a detergent by dissolving and removing foreign matter and the various salts of the sweat secretion. To a certain degree it softens and removes scales and crusts. It is practically not absorbed through the unbroken skin, owing to the presence of fat in the horny layer of the epidermis. Upon the denuded skin it acts as an irritant, and is, therefore, to be avoided in the acute oozing stage of eczema. The effect of water upon the circulation depends upon the temperature at which it is applied. The application of either cold or hot water produces a temporary vasodilatation while that of tepid water causes a vasodilatation from the outset. The action of water is at times antipruritic, or may even be somewhat analgesic by softening painful fissures and dense adherent crusts.

Water may be used externally in the form of full-length or partial baths, douches, wet packs, and compresses. The action of *baths* depends largely upon their temperature and duration, and to a less extent upon their composition. A cold or cool bath of short duration will, for instance, exert its favorable action upon the nervous system, and act as a general tonic. If, however, a marked detergent action upon the skin is desired the bath should be warm and long continued, and especially accompanied by the use of soap. In rare instances it is advisable to make use of the permanent water bath, in which the patient lies continuously for days and weeks. Owing to the inconvenience of maintaining a permanent bath its use is practically limited to certain forms of pemphigus and burns of the second degree in which there has been an extensive loss of epidermis. From the dermatological standpoint, Turkish and Russian baths are of little value, although they are at times employed in the treatment of pruritus and various hyperkeratoses. Medicated baths are used for their palliative or curative effect. Their value, with a few exceptions, is about as slight as that of medicated soaps. The palliative baths are prepared by adding either an alkali, such as bicarbonate of soda or borax (3x to xii), or some mucila-

ginous substance, such as bran (2 to 5 pounds), starch (1 to 3 pounds), or gelatin (1 to 3 pounds) to a full bath, estimated generally at 30 gallons of water. They are at times of real value in the treatment of urticaria, erythema, and prurigo. The alkaline baths can also be used in cases of seborrhea and psoriasis. Of the baths whose action is supposed to be curative, those which contain sulphur are probably of the greatest value. They may be given as natural sulphur baths at one of the various mineral springs, or they may be artificially prepared by adding an ounce of Vlemynx's solution (see Sulphur) to a full bath. Medicated baths containing tar, corrosive sublimate, iodine, bromine, permanganate of potash, menthol, etc., have all been recommended, but are of problematical value.

For the removal of crusts and scales, water can be used to excellent advantage in the form of wet compresses. If covered by some impermeable substance, such as rubber tissue, their macerating action is more pronounced, owing to prevention of evaporation, and they do require as frequent moistening as is otherwise necessary. Compresses are generally made with several layers of gauze dipped in a solution of aluminum acetate (liquor Burrowi) or a saturated solution of boric acid. Wet packs are not often used for the treatment of skin diseases. The direct application to the skin of impermeable substances, such as gutta-percha or vulcanized rubber cloth, has a powerful macerating effect, and is of the greatest value in removing thick and adherent crusts and scales. Such an impermeable covering requires removal and cleansing several times a day to avoid the disagreeable odor resulting from decomposition of sweat and other secretions. Rubber cloth can be conveniently made into garments to be worn upon various portions of the body.

In inflammatory conditions where the application of water is too irritating or an impermeable covering too macerating, crusts and scales are best removed by means of oils or thin fats, such as vaseline or lard. An oil to which 3 per cent. of salicylic acid is added for its mild keratolytic and antiseptic action is in constant use for the removal of crusts upon the scalp. Poultices are not often used at the present day for removing secretions from the skin, as their action is too favorable for the growth of bacteria.

Keratolytics.—Keratolytics are chemical agents that have the power of dissolving the horny layer of the epidermis, and include the caustic alkalies, soaps (particularly the potash soaps), salicylic acid, and resorcin (in strong concentration). Of these, salicylic acid and soap are of particular interest.

Salicylic acid is one of the most valuable remedies in dermatology, and as a keratolytic stands without a rival. In weak solutions (1 to 2 per cent.) it is keratoplastic. In a strength of from 3 to 5 per cent. it is mildly keratolytic, and frequently combined with other remedies to aid in their penetrating the skin. In a concentration of 10 to 20 per cent. its action is strongly keratolytic, causing an exfoliation of the epidermis in the form of a soft, white adherent mass, leaving behind a rosy surface covered with delicate epithelium. The exfoliation always takes

place within the horny layer of the epidermis, and it never leaves behind an ulcerated or oozing surface. Salicylic acid is in constant use for all forms of hyperkeratosis, and is the chief ingredient in all of the advertised "corn cures." It is an antiparasitic of value, and if sufficiently concentrated (10 per cent.) it is somewhat antipruritic. In powder form it is much used as a remedy for hyperidrosis of the feet. Salicylic acid may be applied in almost any desired form.

Soap.—As is well known a soap is a combination of a fatty acid with an alkaline base. Its consistency depends upon the alkali and not upon the form of fat (animal or vegetable) used in its manufacture. Hard soap results from the use of sodium as the alkaline base, and is the type of bland soap which is used for ordinary toilet purposes. Soft soap is obtained by the use of potash as a base. Due to its excess of alkali it is too irritating for ordinary use. For certain purposes, however, it is invaluable. One of the requirements of a good bland soap is that it shall be absolutely pure, containing no by-products, such as glycerin, and that it shall be free from adulteration. A second requirement is that the soap shall be as nearly neutral as possible, *e. g.*, contain no free alkali. To be more certain of blandness and neutrality, Unna has devised his so-called superfatted soaps. These are produced by adding 4 per cent. of fat (olive oil) to a neutral soap made of pure beef tallow. The excess of fat is supposed to saponify and render harmless any slight excess of alkali that may be present. For ordinary toilet use the neutral soaps put upon the market by the best manufacturers are, as a rule, entirely reliable. In cases of extremely delicate and irritable skin the superfatted soaps may be used. The lather which they form is, however, not very copious. Norman Walker suggests that the cause of irritation from the soap may not lie altogether in an excess of alkali, as is generally supposed, but may be due to the use of rancid fat in the process of manufacture. At all events it seems to me that too much attention is generally paid to possible bad effects from the use of soap founded upon imagination rather than upon fact.

The action of hard or soda soaps is that of detergents, dissolving and carrying off foreign matter, epithelial detritus, and dried sweat secretion from the skin. They also remove fat from the epidermis largely by emulsification, but partly by solution and saponification. While indispensable, from a hygienic standpoint, it can hardly be said that the soda soaps are of great medicinal value. They are, however, used for the removal of crusts and scales, and serve as vehicles for other curative agents. The soft or *potash soaps*, on the other hand, are of great value in themselves for the treatment of skin diseases. Due to the excess of alkali, they are powerful keratolytics, softening and dissolving the horny layer, and also acting as stimulants to the skin. A typical example of a potash soap is the *sapo mollis*, or green soap, formed by the combination of potash and olive oil, and containing from 1 to 4 per cent. of free caustic potash. A form in which the *sapo mollis* is often used, especially upon the scalp, is the so-called tincture of green soap (*linamentum*

saponis mollis), which consists of two parts of soap and one of alcohol, to which a little oil of lavender is added.

The activity of a soap is greatly influenced by the manner in which it is applied. The action of a simple washing in cold water, with a neutral or superfatted soap, is very mild, but is increased when the washing is long continued and hot water is used. It is still greater if the lather is allowed to dry upon the skin. It is most powerful of all when a layer of soft soap is spread upon the skin and covered with some impermeable dressing.

From its ability to remove fat from the epidermis, *sapo mollis* is of great value in the treatment of seborrhea of the skin and scalp. Its keratolytic action makes it an invaluable agent for causing exfoliation in cases of acne and rosacea. For the same reason, soap is an important agent in the treatment of psoriasis, chronic eczema, and the various conditions in which hyperkeratosis is a feature. It also aids in the cure of some of the parasitic diseases of the skin.

The practical value of soap as a vehicle for various medicinal agents is, in my opinion, decidedly small. The action of medicated soaps, as Jessner says, is cleanly, economical, and energetic. Among its disadvantages may, however, be mentioned its harmful effects upon acute inflammatory conditions associated with keratolysis, the unreliability of the preparations and their dosage, and the impossibility of combining with many of the valuable dermatological remedies. Medicated soaps are put upon the market as hard, soft, fluid, and powdered soaps.

Stimulating Remedies.—Under this heading are included remedies that are generally used to produce a hyperemia and an absorption of inflammatory exudates. In weak concentration their action is keratoplastic, *e. g.*, they stimulate the transformation of the soft rete cells into the horny epidermal plates. Most of them in moderate concentration are either directly germicidal or indirectly so from their power of depriving organisms in the skin of oxygen. They are termed “reducing” agents by Unna.

Of all the local remedies that are used in dermatology, none is of greater importance than *tar*. It is of the greatest value in the treatment of subacute inflammatory processes from its ability to lessen hyperemia, promote normal cornification, and to cause absorption of inflammatory exudates. It is the type of stimulating remedy that is used in the transitional stage of an acute to a subacute inflammation, such as eczema. In acute conditions accompanied by edematous swelling, by vesiculation or pustulation, its use is, however, absolutely contraindicated. It is always wise to proceed with caution in commencing the exhibition of tar, especially if the physician is not an expert in the treatment of skin diseases. Tar is an antiparasitic, inimical to both animal and vegetable parasites and to bacteria. Its great value as an antipruritic will be referred to later.

Both wood and coal tar may be used for the treatment of the skin diseases, though the employment of coal tar at the present day is rather infrequent. The important preparations of tar are those that are obtained by destructive distillation of wood—namely, *oleum fagi* (pix

liquida), or beach tar; oleum rusci, or birch tar, and oleum cadini, derived from the *Juniperis oxycedrus*. All of these preparations are in constant use, and each has its adherents. Pix liquida and oleum rusci are probably more widely employed by the general practitioner in this country, while the oil of cade is preferred, I think, by those who make a specialty of the study of skin diseases. From comparative tests of these different preparations, Leistikow found the oil of cade to be the least irritating, while in other respects he considered them to possess a similar action. From my own experiments I feel convinced that the oil of cade is the most efficient form of tar, and, in consequence, use it almost to the exclusion of other preparations. The liquor carbonis detergens is a mild preparation of tar that is at times of considerable value on account of its antipruritic qualities. The vehicles for the employment of tar consist of alcohol, oils, salves, pastes, varnishes, and soaps. Tar may also be used as such in full strength. Tar baths are seldom given at the present time.

The undesirable effects that may result from the use of tar include ordinary dermatitis, and the so-called condition of "tar acne," resulting from long-continued exposure of the skin to coal tar or tarry substances. Toxic symptoms may result from the application of tar over a large surface of the body, and include a rise of temperature, nausea, vomiting, diarrhea, and olive-green urine, and should be an indication for the immediate discontinuance of the drug.

Sulphur is one of the few remedies in dermatology that may be considered to be indispensable. Its internal administration, as previously said, is followed by little or no benefit. While it may produce a very severe dermatitis the action of sulphur is never toxic. According to Unna the action upon the unbroken skin is due to the production of hydrogen sulphide, as sulphur itself is inert. It is an antiparasitic of great value, finding universal employment, for instance, in the treatment of scabies. A derivative of sulphur, the hyposulphite of soda, is also constantly used for the cure of tinea versicolor. From its antiparasitic action upon the organism of seborrhea, or from some cause not well understood, sulphur has long been known to be a most valuable remedy in disorders of the sebaceous glands. The addition of green soap, on account of its keratolytic action, increases the value of sulphur in the treatment of acne. There are three forms of powdered sulphur which are officinal—namely, precipitated, sublimed, and washed sulphur. Of these the best preparation is unquestionably the precipitated sulphur (lac sulphuris). It is the purest and most finely powdered of the three forms, and is practically devoid of odor. In addition to sulphur as such, a number of inorganic combinations with alkalis and with calcium are in use. Among these should be mentioned potassa sulphurata, one of the constituents of the well-known and valuable "lotio alba." Various organic combinations of sulphur have been put upon the market, such as the colloid sulphur (recommended by Max Joseph), the soluble sulphur, etc., but have not proved to be superior to preparations already in use. Sulphur is frequently incorporated in soaps, and is an impor-

tant constituent of many mineral springs. For the preparation of a sulphur bath which is useful at times in cases of dermatitis herpetiformis and prurigo, an ounce of Vleminckx's solution to a tub of water is used. The formula for this solution is as follows:¹

R—Calcis	℥ss	5.0
Sulphuris sublimati	℥j	10.0
Aquæ destillati	℥x	ad 100.0
M.—Coque ad ℥vj deinde filtra.		
Sig.—Vleminckx's sol.		

Resorcin (dihydrobenzol) is a many sided remedy that varies greatly as to the extent of its use by different physicians. By some it is constantly, by others infrequently, prescribed. From my own experience I feel that while it has a number of useful properties its value is considerably below that of tar, sulphur, or chrysarobin. Like other strong reducing agents, resorcin is astringent and keratoplastic in weak concentrations (2 per cent.), while in greater strength it is a decided irritant, keratolytic, and even caustic. Resorcin has a considerable reputation as an antiseborrheic remedy. In this respect it has an advantage over sulphur, as it is freely soluble in water, and can, therefore, be used as a lotion for the scalp. Weak solutions are advised by some authorities for the acute stages of eczema and for the cleansing of various ulcerated surfaces. The most important property of resorcin is probably its ability, when used in sufficient strength, 10 to 25 per cent., to cause an exfoliation of the skin, with comparatively little irritation. Several days after the daily application of a strong resorcin paste or lotion the skin becomes dry, brownish, leathery, and inelastic. It soon desquamates, leaving behind a rosy skin covered by delicate epidermis. In this manner resorcin is often used for the treatment of rosacea, with brilliant results. Resorcin may be used for its antiparasitic action in the treatment of ringworm, sycosis, etc., though for such a condition it can hardly rival iodine, sulphur, and the x-ray. In strong concentration it has been used as a caustic for lupus vulgaris. Some advantages possessed by resorcin are its lack of color or odor and its ready solubility in water and alcohol, permitting the application of the drug in almost any desired form. It has the disadvantage of discoloring the skin and hair, the former assuming a brownish and the latter a brownish-red color. A marked idiosyncrasy is at times exhibited toward even weak dilutions of resorcin.

Ichthyol, or, more properly, ammonium-sulpho-ichthyolate, is a product of distillation of a bituminous quartz, containing a large amount of fossil fish. In addition to the ammonium salt a sodium salt is also upon the market. It contains a considerable percentage of sulphur, to which much of its therapeutic value is probably due. Ichthyol differs from

¹ The prescriptions in this chapter are given in both apothecaries' measure and the metric system. The second column is not supposed to be the exact equivalent of the first. It is arranged so that the percentage of each ingredient may be seen at a glance.

other strong reducers in being only slightly irritating in high concentration. Like resorcin it is able to fulfil a good many requirements, but it is a remedy that, in my opinion, is too often used in a haphazard manner. Many physicians employ a 10 per cent. ichthyol ointment as a sort of stereotyped treatment for all forms of eczema as well as many other dermatological conditions. It is often used, naturally without benefit, when either a soothing application, such as zinc oxide or stimulating remedies, like tar or chrysarobin, are indicated. Ichthyol in weak concentration (3 per cent.) is often well borne in acute eczema. For subacute or chronic forms it is much more advisable to employ other remedies, such as tar. Ichthyol may be used as an antiseborrheic, though its disagreeable odor makes it less desirable for use upon the face than sulphur or resorcin. The powerful vasoconstrictor action that is ascribed to ichthyol makes it a valuable remedy for the treatment of chronic passive hyperemias, such as chilblains. It is in the treatment of erysipelas that the most brilliant results have been obtained by the use of ichthyol. Several applications of the pure drug are generally sufficient to cause a decided lessening of the redness and swelling as well as an improvement in the general condition. The vasoconstrictor and antiparasitic action of ichthyol are apparently responsible for its favorable effects in various phlegmonous conditions, such as furuncles, carbuncles, felons, etc. In the treatment of painful fissures, such as those occurring about the anus, ichthyol is at times of great service. As an antipruritic remedy its value is not very great. In the final estimate of the worth of ichthyol it must not be forgotten that its dirty color, disagreeable odor, and high price are all unfavorable to its wide employment. On the other hand, ichthyol is freely soluble in water, and can be readily used in any form of application that is desired.

Chrysarobin, or chrysophanic acid, is one of the most powerful reducing agents we possess, and in spite of its many disagreeable features is an indispensable remedy in dermatology. Considering the value of the drug and its frequent employment by specialists it seems strange that it is so little used by the general practitioner. By some, indeed, its very existence is scarcely known. It is quite possible that the general use of chrysarobin has been somewhat limited, owing to the fear of disagreeable results that it might produce. At all events one can be certain that some results, whether good or bad, will follow its use. It is never inert like so many remedies employed in certain forms of skin disease. From its antiparasitic action, chrysarobin may be used for the treatment of ringworm, chromophytosis, sycosis, etc., though for these conditions other remedies are generally to be preferred. In the treatment of psoriasis, chrysarobin must be considered a specific. It is certainly unequalled by any other local remedy. Chrysarobin is also of value in cases of chronic thickened eczema, hypertrophic lichen planus, and of alopecia areata. It is of value as an antipruritic in cases of eczema and associated with intolerable itching.

Chrysarobin is a powerful remedy whose action must be watched even more closely than that of tar. A certain amount of dermatitis is gener-

ally necessary to obtain the real effect of chrysarobin, though this may attain such a degree as to require immediate cessation of treatment. One of the unavoidable effects of using chrysarobin is a peculiar reddish-brown staining of the skin and nails and a greenish-yellow discoloration of the hair, which, however, gradually disappears in the course of a few weeks. Furthermore, any portions of the clothing or bedclothing that come in contact with the drug are more or less permanently injured. Another disadvantage of chrysarobin is its liability to produce severe conjunctivitis when it is accidentally carried to the eye. This may also occur when there is no actual contact, owing to the fact that chrysarobin is somewhat volatile. The conjunctivitis, while very painful, is of short duration, and is not followed by any permanent injury. Chrysarobin may at times produce a peculiar folliculitis, and in very rare instances its application over a large surface of the body has been followed by symptoms of depression and albuminuria.

In employing chrysarobin it is always advisable to avoid the use of water upon the portions of the body that are being treated. Bathing is not compatible with a general chrysarobin therapy, and invariably increases the severity of the dermatitis that is present. Special stress is laid upon this point by von Zumbusch, though no mention of it is made by the majority of writers.

Chrysarobin is most active when used as an ointment (1 to 20 per cent.). A more cleanly though less efficacious method is to apply it in the form of some fixed dressing, such as collodion or traumaticin. It is tolerated in greater concentration upon the portion of the body where the skin is thick, as the external aspect of the arms and legs. On account of the danger of conjunctivitis it should never be used upon the face.

Pyrogalllic acid (pyrogallol) is a powerful reducing agent that in certain cases may be used as a substitute for chrysarobin. It has the disadvantage of staining the skin and to a less extent the hair, a brownish to blackish color, depending upon the length of time of its employment. On this account it is not suited for use upon the face or hands. As it is fairly soluble in water and freely so in alcohol it has been considerably used in the form of a lotion in spite of its discoloring effects for the treatment of psoriasis of the scalp. In concentrated form it has been employed as a caustic for lupus. Its most important indication is, in my opinion, in the treatment of localized patches of psoriasis. Pyrogalllic acid is a dangerous remedy, as its use has been followed by toxic symptoms, such as chills, rise of temperature, and albuminuria, and in a few instances by death. The appearance of dark greenish urine should be the warning for its withdrawal. Pyrogalllic acid may be applied as an ointment or lotion or in collodion. It should not be used over a large surface of the body, nor should it be employed for children.

Antiseptics and Parasiticides.—It is extremely difficult to disinfect even the horny layer of the epidermis as is shown by the minute pains taken by the surgeon to sterilize his hands. In the case of the mucous layer of the epidermis and the deeper portions of the skin a disinfection is out of the question. It is therefore unwise to attempt to disinfect a

pustular infection of the skin by the use of strong antiseptics, such as bichloride of mercury, carbolic acid, formalin, etc. More harm than good is liable to result from their use. The rational treatment of most infected surfaces consists in asepsis rather than antiseptics, and above all in proper and efficient drainage. In the case of large purulent areas this is best effected by the application of wet dressings. Proper measures should also be taken to remove all crusts and coagulable secretions from the skin as fast as they form. This is one of the two essential rules, according to Leredde, of cutaneous asepsis. The other rule is that every cavity formation that is infected should be widely opened. As an example, bullæ and large pustules should be widely opened by sterile scissors rather than by a needle, and hairs about which pustules are developing should be epilated. While asepsis is to be preferred as the method of choice, antiseptics has certain indications in the treatment of pus infection of the skin. The removal, for instance, of ecthyma crusts should be followed by the application of an antiseptic, such as the white precipitate of mercury, while the treatment of various ulcers (*ulcus molle*) requires the use of an antiseptic for a considerable period. The removal of bacteria from the skin may be caused indirectly by keratolytic (soap) or reducing agents (*chrysarobin*), which are probably not in themselves bactericidal.

In the treatment of the ordinary animal and vegetable parasitic diseases of the skin there are three remedies which are of particular value—namely, *sulphur and its compounds, the mercurial salts, and iodine*. The various uses of sulphur have already been described, and it seems advisable at this point to briefly discuss the value of some of the mercurial preparations. The most important salt of mercury, is the white precipitate. Indeed, it is one of the most important and widely used remedies in dermatology. It is an invaluable antiseptic and antiparasitic. It is a moderate irritant, and is, therefore, valuable for causing hyperemia and the absorption of inflammatory exudates. It is in constant use for the treatment of psoriasis, especially of the scalp. It is relatively non-poisonous, though if used in large enough amount it may be absorbed and cause symptoms of mercurialism. The action of corrosive sublimate is too irritating to allow its general employment as an antiseptic. It is useful in rather concentrated solution for the treatment of pediculosis pubis. On account of its ability to cause an exfoliation of the skin (keratolytic action) it is also of value in the treatment of pigmentary conditions, such as *chloasma*, *lentigo*, etc. Aside from its use as a cathartic and for intramuscular injections in syphilis, calomel is only used occasionally as a dusting powder for ulcerations. The yellow oxide of mercury is a favorite remedy for blepharitis, being non-irritating to the eye, and the oleate is useful as a mild stimulant. The blue ointment, aside from its use in syphilis, is an uncleanly remedy that can be dispensed with entirely.

Caustics.—The use of *caustics* in dermatological therapeutics has been somewhat lessened since the introduction of some of the newer methods of treatment, including radiotherapy, phototherapy, the high-frequency

current, and carbonic acid snow. Caustics are, nevertheless, of considerable value, as shown by the great variety of indications for their use, such as nevi; condylomas; lupus; leprous and syphilitic growths; simple, chancreoid, and phagedenic ulcers; bleeding and oozing surfaces; hyperidrosis, dog bites, etc. Caustics may conveniently be divided into those whose action is more or less superficial and those whose action is deeply penetrating.

As a superficial caustic, *silver nitrate* has a well-earned reputation. It coagulates albumin and forms blackish crusts, which prevent any but the most superficial action. It is of no value where depth of penetration is desired. For this reason its employment in the treatment of warts and of leukoplakia is not productive of any beneficial result, and the same may be said, I think, of the treatment of lupous nodules. The superficial action of silver nitrate makes it of value in certain cases of weeping and crusted eczema, where the remedy may be painted upon the surface in dilutions varying from 1 to 10 per cent. in strength. It is hardly necessary to call attention to the universal application of silver nitrate for the treatment of exuberant and sluggish ulcerations and mucous patches. Silver nitrate is also in constant use as a hemostatic following slight dermatological operations.

Carbolic acid is a superficial caustic, and acts like silver nitrate in coagulating albumin. Its action is also moderately anesthetic. Its great value as an antipruritic will be referred to elsewhere. *Chromic acid* is a caustic that in concentrated form may cause poisoning from absorption. It is used in diluted form in ulcers of the tongue, leukoplakia, hyperidrosis of the palms, and in the treatment of burns. From the fact that it is not poisonous, lactic acid is frequently used as a caustic for lesions of the mouth and tongue. *Trichloroacetic acid* combines the caustic action of chlorine with the powerful keratolytic action of acetic acid. It is, therefore, of value for warts, callosities, etc., where the horny layer is thickened, and in addition for condyloma, angioma, lupus, etc. The *acid nitrate of mercury* is valuable where a moderate caustic action is desired, such as that following curettage of superficial epithelioma or rodent ulcer.

Among the most powerful and deeply penetrating caustics should be included fuming nitric acid, zinc chloride, caustic potash, and the galvanocautery and thermocautery. *Fuming nitric acid*, while extremely powerful, is seldom used, owing to the pain which it causes and the difficulty in limiting its action. *Zinc chloride* is a slow and rather painful escharotic whose action is to produce a hard, adherent, and more or less self-limited crust. It forms the basis of Canquoin's paste. The action of *caustic potash* is rapid, penetrating, temporarily painful, and somewhat difficult to control. It forms an alkali-albumin, dissolving the various constituents of the skin and subcutaneous tissue, and transforming them into a moist and soft eschar, which can be easily removed by mechanical means. Its action is thus in marked contrast to that of the acid caustics, the eschars from whose use are hard, dry, and adherent. Caustic potash is not suitable for the

treatment of very vascular tissue, as its power of coagulating albumin is not great, and as the soft nature of the eschar is not suited to check a surface hemorrhage. In such cases the employment of fuming nitric acid is rather indicated, as its action is not only penetrating, but also productive of an eschar that is dry and firm. Caustic potash may be used in pastes for malignant growths and in dilution (10 to 30 per cent.) for a preliminary keratolytic action in the treatment of lupus, various keratoses, diseases of the nails, etc. A surface that is treated by caustic potash should be neutralized by vinegar or some dilute acid after cauterization. The surrounding normal skin should also be properly protected.

Arsenic is a powerful caustic, which appears to have a certain selective action, sparing the normal and destroying the pathological tissue with which it comes in contact. Its action, which is supposed to be due to giving off oxygen, is painful and slow, and requires one or more days for its completion. It is used as a paste, with one or two parts of acacia, for the treatment of small malignant growths. This procedure is apparently without danger, while if the drug is used in a less concentrated form there is always a possibility of poisoning from absorption.

Anesthetics.—A partial anesthesia can be produced by the application to the skin of a solution of carbolic acid. In order, however, to obtain a complete local anesthesia it is necessary to use either the method of freezing or that of injection, with cocaine or one of its substitutes. All freezing methods have the disadvantage of causing slight pain and a tendency to hemorrhage during the process of thawing, and the anesthesia which they produce is of very short duration. A much more serious disadvantage is that it is impossible to distinguish pathological from normal tissue by either sight or touch. It is thus impractical to treat individual lupus nodules, as they cannot be seen when frozen. It is also very unsatisfactory to attempt curettage after freezing, as it is then impossible to recognize soft pathological tissue by the sense of touch. Freezing may be accomplished by a spray of ether, ethyl chloride, or methyl chloride. Ether is too inflammable for practical use. Ethyl chloride is also inflammable, and if used as an anesthetic previous to cauterization by heat, care should be taken to see that the excess of liquid is removed by absorbent cotton or has thoroughly evaporated. Ethyl chloride is, however, the most practical agent for freezing, as it can be preserved in small glass bulbs which can be manipulated with very great ease. While methyl chloride produces a deeper and more lasting anesthetic, it is inconvenient to use, as it evaporates rapidly and must be kept in specially constructed double-walled receptacles.

It is not my intention to describe the technique of cocaine anesthesia as applied to the skin or mucous membranes, as the subject is one that is so universally understood. Space will not permit a discussion of the relative value of cocaine and some of its substitutes, including eucaine B, stovain, novocain, nirvanin, aneson, hydrochlorate of quinine, etc. It may be said, however, that eucaine B seems to be less toxic than cocaine, while practically as efficient. Solution of eucaine B can, furthermore, be sterilized by boiling. Cocaine, like *cannabis indica*, is

frequently prescribed by the general practitioner in ointments for its anesthetic or rather analgesic effect. The value of cocaine under such conditions is generally very slight. It is not absorbed from the unbroken skin, and when applied to a denuded surface will often prove irritating. Furthermore, it cannot be used over an extensive area on account of the danger of absorption. Under any circumstances its analgesic action is of short duration.

A rather unusual analgesic effect is at times produced upon ulcerated surfaces by the application of orthoform. Its analgesic action, which lasts several hours, is preceded at the outset by a sensation of burning. Orthoform occurs as a crystalline powder, and is used as such or in combination with indifferent powders, or less advantageously in ointment form. Its effect is occasionally very unfavorable, as shown by an increase in the size of the ulceration, the formation of gangrenous sloughs, and the appearance of a pustular dermatitis of the surrounding skin. The price of orthoform is unfortunately very high.

Physical Agents.—The discoveries of recent years have greatly increased the importance of various physical and mechanical agents for the treatment of skin diseases. As the general subjects of radiotherapy, high-frequency currents, and electricity are elsewhere described in full, they will only be mentioned in this section where it is thought that they are especially indicated. Phototherapy will be briefly discussed under the subject of lupus. The use of cold as applied in the form of liquid air and carbonic acid snow will be described under the treatment of nevus, while the indications for mechanical pressure, massage, etc., will be later considered. A number of instruments, in addition to those contained in the ordinary surgical pocket-case, are in constant use in dermatological practice. They include the various forms of curette, comedo extractor, scarifier, epilating forceps, electrolytic needles, etc., and will be described in the text that follows.

Methods of Applying Local Remedies.—Powders.—Various substances of vegetable or mineral origin are used as bland, indifferent powders for their physical action upon the skin. In addition a number of medicinal agents can be used in the form of powders for their antiseptic, astringent, antihidrotic, and antipruritic effects. The action of indifferent dusting powders is protective and absorbent. They afford a moderate amount of protection from air, moisture, the friction of the clothing, and of surfaces of the body in opposition. From their power of absorbing secretions, such as perspiration, they are indirectly cooling. This is explained by the fact that a layer of minute spherical particles (of which the powder is composed) offers a larger area for evaporation than that of the skin, which is roughly a plane surface. The cooling effect of powders can be utilized in various hyperemic and inflammatory conditions.

Among the dusting powders of vegetable origin, starch (derived from either rice or wheat) is the most important and most frequently used. It is extremely soft to the touch, but has the disadvantage of forming clumps, or "cakes," when brought in contact with considerable moisture.

Lycopodium is not affected like starch by the presence of moisture, and is an exceedingly soft and light powder. It is in fact the lightest substance in the *Pharmacopœia*. It is, however, not extensively used at the present time, owing to its high price and the frequency of its adulteration.

Of the many mineral substances that are used as dusting powders the most valuable are zinc oxide and talcum (magnesium silicate). Several others should also be mentioned on account of special properties which they possess. Magnesium carbonate, for instance, is by far the most absorbent of any of the indifferent powders. Stearate of zinc, on the other hand, is a particularly adherent powder that is almost impermeable to moisture. When a flesh color is desired it is convenient to use calamine (impure carbonate of zinc) in combination with other indifferent powders. In general, it may be said that the mineral powders are of greater value than those of vegetable origin. The vegetable powders are softer to the touch, but, with the exception of *lycopodium*, they undergo fermentation in the presence of moisture. They are, therefore, not as suitable as the mineral powders for the treatment of intertrigo.

Powders are applied by being dusted over the skin, or, if a more convenient effect is desired, they can be placed in bags of some porous material and fastened upon the skin. Powders are contraindicated where there is an abundant serous or purulent discharge.

Lotions.—The term lotion is generally used to include either solutions or suspensions of medicinal agents in *varia menstrua*, such as water, alcohol, etc. Lotions are cleanly and convenient applications for the face, scalp, and hands, and for surfaces of the body in apposition where the presence of a greasy substance is often disagreeable. Their action is more efficient than powders, but less so than ointments or pastes. According to their composition, lotions are classed as soothing, astringent, stimulating, antipruritic, and antiseptic. A type of soothing lotion is the well-known "lotio calamine and zinc oxide," the usual formula of which is as follows:

R—Calamin	℥ij	6.0
Zinc. oxidi	℥iv	12.0
Glycerini	℥vj	18.0
Liquoris calcis	℥j	36.0
Aquæ ad	℥iv	ad 100.0—M.
Sig.—External use.		

This consists simply of powders held in suspension which are left upon the surface of the skin after the evaporation of the fluid constituents. To lessen the drying effect of a lotion a small amount of glycerin (1 per cent.) can be added. In the case of lotions containing powders in suspension or so-called "shake mixtures," this has the added advantage of causing the powder to adhere to the surface. If used in too large an amount, glycerin may prove very irritating. If it is desired to increase the drying or evaporating effect, alcohol may be added or used alone as the menstruum. A most valuable soothing and slightly astringent lotion is the liquor Burrowi, an 8 per cent. solution of aluminum acetate in water. In a dilution of 5 to 10 parts of water it is universally

employed not only as a lotion, but also in the form of wet compresses. Lotions are conveniently applied with the hand or by means of a piece of gauze or muslin; the use of absorbent cotton is best avoided.

Ointments.—Ointments are semisolid preparations, composed of fats or fat-like substances, and are more extensively used than any other methods of local application. The value of ointments consists in their ability to introduce fat into the skin, to serve as a vehicle for various medicinal agents, to furnish protection from friction, moisture, and atmospheric changes, and to soften and aid in the removal of crusts and scales. The action of ointments when rubbed into the skin or applied beneath a bandage is, according to Leistikow, to cause a stoppage of the cutaneous secretions and a swelling of the epidermic cells. This increases the absorptive powers of the skin, and allows the deep penetration of both fatty and medicinal components of the ointment. The imbibition of the horny layer with fat protects the skin from drying, by hindering cutaneous secretions, and by lessening the evaporation of moisture.

Ointment bases are composed of fats of animal and vegetable origin, and of fat-like substances, and include lard, lanolin, wax, spermaceti, olive and sweet almond oil, cocoa butter, vaseline, and paraffin. By using various combinations of these substances an ointment of any desired consistency can be obtained. The firmness of an ointment is increased by adding wax or spermaceti, its softness by adding oils or glycerin.

The most valuable ointment bases are benzoinated lard, vaseline, lanolin, and cold cream. Of these the benzoinated lard is the most widely used. It is, however, more apt than the others to become rancid. Vaseline is a mixture of hydrocarbons, with physical properties similar to those of a fat. It is obtained as a by-product in the refinement of petroleum, and is on the market as yellow and white vaseline. The white or bleached variety is more elegant in appearance, but is more apt to irritate, and is, therefore, inferior to the ordinary yellow vaseline.

Lanolin is a complex fat, containing cholesterin, derived from sheep's wool. It is somewhat analogous in its structure to the natural fat of the human skin. Lanolin (or the closely allied *adepts lanæ*) is non-irritating, as a rule, and does not easily decompose. It is readily miscible not only with other fats and with glycerin, but also, to a marked degree, with water. This property has been utilized by Unna to form the so-called "cooling salves," which contain a large percentage of water, the evaporation of which produces the cooling effect. For the preparation of such an ointment the anhydrous form of lanolin is used. Lanolin has the disadvantage of being stiff and tenacious, and difficult to rub into the skin. This is overcome by using it in combination with vaseline or some fluid oil. Cold cream (*unguentum aquæ rosæ*) is an elegant ointment base composed of oil of sweet almonds, wax, spermaceti, and rose water. It contains 20 per cent. of water, from the evaporation of which its cooling effect is probably due.

Ointments are applied upon strips of muslin or gauze, or rubbed into the skin with friction. It is upon the vigor with which friction is used that the penetrating power of ointments largely depends. Lanolin, however, has the reputation of being able to penetrate the skin deeply, although rather slowly. Goose grease (*adeps anserinæ*) is also said to have a special penetrating power, and is strongly recommended by Dr. George T. Jackson for the treatment of ringworm of the scalp. A properly made ointment should be free from gritty particles, and, of course, contain no rancid fat. It should have a melting point somewhat above that of the body temperature. To prevent softening in hot weather it is advisable to add 10 to 20 per cent. of wax.

Pastes.—Pastes are combinations of powders and ointments, with which various medicinal remedies may be incorporated. To the presence of the powder is due their valuable property of being able to absorb secretions from the skin. Unlike ointments, which form an impermeable covering, pastes are porous, and allow the evaporation of moisture. They are, therefore, not as liable as ointments to cause hyperemia and irritation. In general, it may be said that pastes are indicated for acute inflammatory surfaces, with or without oozing, whereas chronic dry inflammatory conditions are more suited for the employment of ointments. Pastes are also more adherent than ointments, and require no protective dressing if their consistency is sufficiently firm. Vaseline is generally used as the greasy constituent of pastes, though for this purpose litharge or gum arabic can be substituted. The powders most frequently used are zinc oxide, starch, kaolin (*bolus alba*), prepared chalk, and terra silicea, a diatomaceous sand, recommended by Unna on account of its absorbent powers. Magnesium carbonate is very absorbent, as has been said, but, owing to its light weight, is not suitable for pastes, as it must be used in large amount to give a proper consistency. Pastes are applied by simply smearing them upon the skin with the hand, or they can be first spread upon muslin or gauze and then laid upon the surface and covered by a bandage. To give additional protection it is often well to cover a paste by some indifferent dusting powder.

Both ointments and pastes can be moulded into the form of solid crayons by the addition of hardening substances, such as wax, starch, dextrin, tragacanth, etc. In this form they can be applied in a few selected conditions with convenience and great economy.

Oils.—Aside from their use in the composition of ointments, simple bland oils, such as olive or sweet almond oil, are useful for soothing inflamed surfaces, and, as has been said, for softening and removing crusts and scales. Linseed oil is a component of the well-known carron oil. Crude petroleum is a cheap and efficient remedy for removing pediculi from the scalp. Castor oil forms a valuable addition to lotions for the scalp, as it is soluble in alcohol. Cod-liver oil has been used externally for ichthyosis, and chaulmoogra and gurjun oils for leprosy. The use of tar oils has already been discussed. As vehicles for carbolic acid the bland oils are unsurpassed.

Varnishes.—A varnish is a dressing that is applied to the skin in the form of a liquid that soon dries and leaves behind a protective covering. Varnishes are either soluble or insoluble in water. The soluble varnishes are used, as a rule, for their soothing and protective action. Medicinal remedies may be added, but they are not as active as when used in the form of ointments or pastes. The various soluble varnishes are indicated for inflamed and irritated surfaces of moderate extent. They do not interfere with evaporation of moisture, and are consequently not macerating in their action. According to Leistikow they actually increase the evaporation of moisture. They exert a certain amount of compression, and are especially valuable for lesions associated with varices. They are contraindicated for freely discharging surfaces. The glycogelatins consist of gelatin, glycerin, zinc oxide, and water, in varying proportions, according to the consistency that is desired. To increase the protection afforded by the glycogelatins a layer of gauze or absorbent cotton can be applied over the jelly before it has dried, or, after drying, an indifferent powder can be dusted over the surface. In addition to gelatin other gummy substances can be used to make a soluble varnish, such as tragacanth (the basis of the linimentum exsiccans of Pick) or bassorin, first suggested by Elliot. More recently, Unna has recommended a combination of gelatin and tragacanth, which he terms *gelanthum*. The following are the formulæ of Unna's glycogelatins:

R—Zinci oxidi	15 parts.
Gelatini	15 parts.
Glycerini	25 parts.
Aquæ	45 parts.—M.
Sig.—Soft jelly.	

R—Zinci oxidi	10 parts.
Gelatini	30 parts.
Glycerini	30 parts.
Aquæ	30 parts.—M.
Sig.—Hard jelly.	

The gelatin is dissolved upon a water bath, and the zinc oxide and glycerin previously mixed are then added.

The insoluble varnishes, such as collodion, and traumaticin are used as protective dressings for localized areas. The covering which they form is waterproof, but does not interfere with evaporation of perspiration, and produces therefore no maceration. The insoluble varnishes are frequently used as vehicles for medical agents, and are also valuable for the compression which they cause upon drying. Collodion is the type of varnish most frequently used, and is a solution of guncotton in a mixture of ether and alcohol. It is particularly valuable as a vehicle for salicylic acid. For ordinary purposes the flexible collodion is used, though the plain variety is preferable when a more powerful compressing action is desired, as in the treatment of *pernio*. Traumaticin is a solution of gutta-percha in chloroform, and is a cleanly vehicle for the application of chrysarobin. The protective film that is formed by

traumaticin does not dry as quickly, and is not as firm and strong as that produced by collodion. Another varnish that has been suggested is known as filmogen, and is a solution of cellulose in acetone, containing a small amount of oil. The insoluble varnishes can be applied only to dry surfaces, which should be previously rendered as aseptic as possible. Their action is at times apt to be irritating, and they should, therefore, only be used for patients under frequent observation.

Plasters and Plaster Mulls.—Plasters are used when an intensive action over a localized area is desired. From a dermatological standpoint they are not of very great value, with the exception of the mercurial plaster, which is widely used for the treatment of tuberculous and gummatous syphilides. The officinal plasters have as their basis adhesive plaster (a mixture of rubber, vaseline, and litharge). They are inferior to the plaster mulls introduced by Unna. These consist of muslin, rendered impermeable by a small amount of gutta-percha, upon which the plaster mass containing medicinal agents is spread. On account of their impermeability the action of the plaster (and plaster mulls) is to cause maceration and a deep penetration of the incorporated remedy. They are, furthermore, protective, cleanly, and easy to apply. The plaster mulls can be imported and used in this country, as they keep well for a long time and are sold at a moderate price.

The salve mulls, also introduced by Unna, consist of ointments of various kinds that are spread upon one or both sides of muslin cloth in a basis consisting of mutton tallow, with a small amount of wax. They are elegant preparations, which, however, deteriorate in a comparatively short time, and are, therefore, not very available for use in America.

TREATMENT OF SPECIAL SKIN DISEASES.

Acne Vulgaris.—Acne vulgaris is one of the diseases of the skin in which the results of treatment can be most gratifying if a little care and patience are exercised in the study of each individual case. While a temporary improvement will generally follow any judicial plan of treatment, a permanent cure of acne is sometimes difficult to obtain. It is true that after the age of twenty-five, acne (of the face) tends to disappear spontaneously. To wait, however, for nature to effect a cure would not only result in years of annoyance to the patient, but would allow free scope to the formation of pustules, with their resulting scars. That more or less scarring may result from the disease itself should be explained to the patient, but it should also be made clear that this can be greatly lessened by instituting proper treatment.

While the treatment of acne is essentially local it must be admitted that the disease is also strongly influenced by the institution of general hygienic measures. This is especially true of the cases where the skin is hyperemic and irritable, and associated with frequent flushing. In any case, however, the management of acne must include a careful consideration of questions relating to diet, exercise, bathing, sexual hygiene,

etc. The diet should be plain and wholesome, and the use of alcohol, tea, coffee, pastry, and indigestible food in general should be prohibited. Anemia, constipation, indigestion, and menstrual disorders should all receive appropriate treatment. Arsenic may be of value in a few chronic cases of the indurated type. As a rule, however, the disease is not affected in the slightest by the internal administration of drugs.

Before discussing the various methods of local treatment it is advisable to call attention to the pathological condition of the skin that we are called upon to treat. Acne is a chronic inflammatory disease of the sebaceous glands, due, in all probability, to an infection with an organism called the *microbacillus* of seborrhea by Unna and by Sabouraud, and termed the *Bacillus acnes* by Gilchrist. In the majority of cases the skin is unnaturally oily, anemic, and flabby. It is generally the seat of more or less pustulation, due to secondary infection by the ordinary pus cocci of the skin. The indications for treatment consist, therefore, in local applications to remove the excess fat, to stimulate the skin and to attack the pustulation. This is best accomplished, in my opinion, by a combination of mechanical and chemical methods

FIG. 60



G. H. Fox's ring curette for acne.

FIG. 61



G. H. Fox's comedo scoop.

It is upon the mechanical treatment of acne, more especially upon the use of the curette, that I should like to lay stress, largely because it does not seem to be properly understood, and has not received the recognition that it deserves. The operation of curetting the skin demands a little care in the selection of the instrument and some slight experience in its employment. For this purpose either Fox's ring curette (Fig. 60) or an ordinary bone curette may be used, provided that they are dull enough to avoid cutting or injuring the normal skin. The use of the curette over the entire affected surface once or twice a week removes a large number of the comedones, scrapes off the tips of some of the papules, and stimulates the skin by producing a hyperemia. The presence of a moderate amount of pustulation, in spite of theoretical objections, is not a contraindication to the use of the curette. Even the discomfort of curettage is well borne by the majority of patients in both private as well as dispensary practice. The mechanical removal of the comedones by any of the numerous comedo extractors (Fig. 61) and the incision of pustules by a fine eye knife or lancet should be performed by the physician once or twice a week. In the case of large pustules

or purulent cystic lesions it is often advisable to introduce a drop of pure carbolic acid upon a convenient applicator, such as a sharpened toothpick.

The chemical method of treating acne includes the use of two time-honored remedies—namely, soap and sulphur. From its ability to remove fat from the skin, soap, especially the potash or soft soap, is an invaluable remedy for acne. Soft soap is also of great value in stimulating the skin and favoring the absorption of inflammatory exudates. The degree of its action will vary according to the length of time that it remains in contact with the skin. The usefulness of sulphur is due to its action as a powerful stimulant, and probably also to its antiseptic action upon the acne bacilli. It is conveniently used in the form of the so-called “*lotio alba*,” a mixture that should have a perfectly white appearance when properly made. Its usual formula is as follows:

R—Zinci sulphatis,					
Potassæ sulphuratæ	āā	3j-ij	āā	4 to 8.0	
Aquæ	q. s. ad	3iv—M.	ad	100.0	

Sig.—External use.

The drying action of the lotion can be lessened by the addition of 1 per cent. of glycerin, while if a more powerful action is desired, 4 per cent. of precipitated sulphur may be added.

My routine management of a case of mild or moderate severity consists in addition to general hygienic measures in advising the patient to wash the face vigorously every night with the tincture of green soap and water for about a minute. The skin is then to be massaged for a few minutes by pinching it between the thumb and forefinger, after which the *lotio alba* is applied with the hand and allowed to remain on the skin over night. The face is treated, in addition, once or twice a week, by the mechanical methods above described. As improvement appears the intervals of curetting may be lengthened and the soap friction gradually lessened in frequency. I do not employ the method of steaming the face or applying hot compresses to facilitate the removal of comedones, as it seems to me that the application of heat tends to increase the already relaxed condition of the skin. I have found that a preliminary scrubbing of the skin with a pledget of cotton dipped in alcohol is of sufficient aid in removing comedones.

In certain cases of acne, where a rapid curative effect is desired, one of the various exfoliative methods can be used. For this purpose resorcin is our most valuable agent, and is best used in the form of a 10 to 20 per cent. paste. This is rubbed upon the skin and allowed to remain several days until the skin becomes red and tender, after which the paste is removed and cold cream or other bland ointment is applied. This is followed by a certain amount of exfoliation which removes a large number of the comedones. Although rapid and effective, resorcin treatment causes considerable discomfort, and confines the patient, as a rule, to the house. Furthermore, it is necessary to repeat the treatment at intervals. A similar exfoliation may be caused by rubbing green

soap upon the skin and allowing it to dry, and repeating this process on several consecutive days. Bichloride of mercury is also used by some in the form of a lotion (1 to 1000) for its exfoliative effect.

The value of the *x*-rays in the treatment of acne is, in my opinion, confined chiefly to the severe indurated cases, especially those occurring upon the back and shoulders. It is true that the *x*-rays are used by some as a routine method in all cases of acne, and I must admit that good results are often obtained in this manner. Personally, I do not care to use the *x*-rays upon acne of the face except in certain severe cases. I feel that it is improper to use such a powerful and at times dangerous remedy as the *x*-rays for cases that can be successfully treated by other simple and perfectly safe methods. In cases of acne of the back, which are so often of the severe type, I consider the *x*-rays the method of choice. In order to lessen the possibility of causing telangiectasis, it is always advisable to be cautious and avoid the production of an erythema. During the treatment it is best to stop the use of irritating drugs that might mask the appearance of an erythema. The surgical treatment of the pustule is, however, not contraindicated by the *x*-ray treatment.

The expectations and hopes that were raised by the first reports upon vaccine therapy in acne have unfortunately, not been fulfilled. My own experience with a stock vaccine at the Skin and Cancer Hospital coincides with that of a number of my colleagues in this city. A few of our patients showed some improvement, although in the majority of cases there were only failures to report.

Alopecia Areata.—While the average case of alopecia areata is cured spontaneously after a period varying from a few months to several years, there is no doubt that a cure is often hastened by the institution of treatment. In such a self-limited disease it is hard to judge of the value of any particular therapeutic method, and to claim that there is any one "best remedy" for alopecia areata would, I think, be unwarranted. Alopecia areata is best treated by the persistent local applications of stimulating remedies. As the disease is considered by some to be of microbic origin, stimulating drugs may be chosen which at the same time are antiseptic. Personally, I think that the great majority if not all of the cases are of nervous origin, and consequently do not think it necessary to take any measures to prevent contagion.

The remedy that has given me best results is chrysarobin, a drug that must be carefully used to avoid the danger of conjunctivitis (see page 769). It can be applied as an ointment or as a saturated solution in chloroform upon which a layer of collodion is painted as soon as the chloroform has evaporated. A convenient method of using chrysarobin for limited patches is by means of Unna's salve pencil. Other remedies which have been followed by good results in my experience are applications of liquor ammoniæ fortior and the oleate of mercury. Painting the areas with pure carbolic acid (Bulkley) or trikresol (McGowan) is at times followed by a cure. Some good results have also been reported by the use of the Finsen light and by the Kromayer lamp. In a half-dozen cases in which I tried Piffard's iron electrode lamp the results were

entirely negative. I should advise against the use of the *x*-rays when other simpler methods may succeed. In alopecia areata of the beard the patient should be advised to shave daily, to make the disease less conspicuous. In cases of total alopecia and in alopecia areata occurring in patients over fifty years of age treatment is generally hopeless.

Alopecia Prematura.—In any case of premature baldness our first duty is to ascertain whether the patient is suffering from the condition known as “dandruff,” which is usually a combination of pityriasis and of seborrhea. The remedy which in my experience has proved the most valuable for such cases is sulphur. This is preferably used as a cream in the proportion of one part of precipitated sulphur to eight parts of unguentum aquæ rosæ. It is my custom to add to this 10 per cent. of oil of cade if the odor of tar is not objectionable to the patient. The ointment should be applied in small amount to the scalp at night, and by the following morning the odor will have entirely disappeared. I have found this remedy at all events to be tolerated by some very fastidious women. Dandruff may also be very successfully treated by the use of resorcin or bichloride of mercury, preferably in the form of lotions. Useful formulæ containing these remedies are as follows:

R̄—Hydrargyri bichloridi	gr. j	0.4
Eurosol	ʒj	4.0
Olei ricini	ʒtt iij	1.5
Spiritus formicarum	ʒss	10.0
Alcoholi q. s. ad	ʒiv	100.0—M.
Sig.—For “dandruff.”		

R̄—Resorcini (Merck)	gr. xv	1.0
Spiritus odoratæ	ʒj	25.0
Mentholi	gr. v	2.0
Alcoholi q. s. ad	ʒiv	100.0—M.
Olei ricini	gti. viij	
Sig.—For “dandruff.”		

In the majority of cases frequent shampooing is beneficial rather than harmful, as many have claimed. If the scalp is naturally very oily the tincture of green soap can be used for the shampoo, while if the scalp is dry and lustreless it is advisable to use an ordinary neutral soap. My routine plan of treatment is as follows: The patient is advised to shampoo the scalp twice a week for the first month, once a week for the second month, and once in two weeks for the third month. The sulphur cream, with or without tar (or any other remedy that is chosen), should be applied to the scalp every night for a month, and after that at greater intervals. In any case the treatment, in order to be successful, must be faithfully and persistently carried out, and a cure or even improvement should not be expected at once.

In the cases of falling of the hair in which there is no dandruff whatever, and often no ascertainable cause, we can often benefit the patient by improving the general health. If the scalp is anemic or is not loose and pliable, some good may be accomplished by massage. This should consist in moving the scalp upon the tissues beneath and

not in merely rubbing the fingers over the hair. Brushing the hair morning and night with a stiff brush and applying a wire brush attached to the negative pole of a galvanic battery are beneficial measures, in my opinion. The use of various stimulating lotions containing cantharides, quinine, etc., known as "hair tonics," have never appeared to me to be of much value.

Chromophytosis.—Chromophytosis (*tinea versicolor*) is a superficial parasitic affection that is readily cured by the classical treatment of scrubbing the skin with green soap and water and then rubbing in (with a cloth) a saturated solution of hyposulphite of soda. The treatment is to be repeated every night and for some time after the patches have apparently disappeared, as if any of the parasites (*Microsporon furfur*) remains the disease will again make its appearance. The pubic region should receive special attention in the scrubbing process, as the patches are often unnoticed in this location. To prevent reinfection the underclothing should be frequently changed and thoroughly boiled before being worn again.

Dermatitis Herpetiformis.—Dermatitis herpetiformis is one of the few diseases of the skin in which arsenic is apt to produce notable results. This can be administered in any of the forms described (see page 758), and should be given a trial for several months in every case. The disease is frequently obstinate enough to tax all of the physician's tact and knowledge in improving the patient's general health. A complete rest and change of scene are often urgently required.

The local treatment should consist in frequent baths and antipruritic and stimulating applications. The alkaline and emollient baths, and especially those containing sulphur, should be tried. The use of sulphur, originally proposed by Duhring, is highly recommended by Norman Walker, and has certainly been followed by good results in my experience. It is applicable only to the vesicular and bullous variety, and is preferably used as a 10 per cent. ointment, vigorously rubbed into the skin. In the erythematous form it is better to use milder antipruritic applications, such as 10 per cent. oil of cade in zinc oxide ointment, 1 per cent. menthol in sulphur ointment, or a weak solution of liquor carbonis detergens. Hardaway and Grindon have obtained satisfactory results with Pick's linamentum exsiccans, containing in addition 10 per cent. zinc oxide and 1 per cent. carbolic acid. Dr. George T. Jackson found that the spinal douche acted most favorably in one of his cases. Winfield recommends liquor picis alkalinus (℥j to ℥viij to xij of water) or liquor carbonis detergens (℥j to ℥iv to vj of water).

Eczema.—Eczema is a disease of very considerable importance, as it constitutes one-third of the number of skin diseases for which medical aid is sought. It may be given, as a rule, that every case of eczema requires some form of local treatment. Indeed, it is often possible to effect a cure by the use of local remedies alone. In the majority of cases, however, the disease is the expression of some departure from the normal health, and demands, often imperatively, proper constitutional treatment. The management of eczema will, I think, be most successful in

the hands of the physician who combines a resourceful knowledge of general medicine with a certain amount of experience in diseases of the skin. While it is true that certain cases of eczema are extremely rebellious to treatment and call for an exhibition of great perseverance, it can be truly said that no case of eczema is incurable. It is certainly true that in some cases, in spite of our efforts, a cure cannot be effected without a complete change of scene or mode of life.

The remarks that have been made in the first part of this chapter with regard to diet, exercise, and the use of diuretics (including water) are especially applicable to the treatment of eczema and need not be repeated at this point. It may simply be said that there is no special diet to be adopted in all cases of this disease. What has been said in regard to strict training in certain diseases of the skin also applies with particular force to certain cases of eczema. Many a plethoric and overfed patient will show a wonderful improvement after a loss of ten to fifteen pounds, while other patients will improve by building up with milk and eggs and tonics. The duty of the physician will include a careful consideration, and judicial treatment of constipation, digestive disturbances, anemia, rheumatic diathesis, or any other ascertainable departure from the normal health.

While the general hygienic measures are of the greatest value in the treatment of eczema, comparatively little good can be accomplished by the internal administration of drugs with the exception of laxatives, tonics, and diuretics. There is certainly no specific treatment for eczema. Arsenic is not of great value in this disease, and should be the last rather than the first remedy to be tried.

In the local as well as the general treatment of eczema it may be said that there is no remedy or no combination of remedies whose action is specific. The physician will obtain better therapeutic results by learning the action of several reliable drugs and their proper application rather than by using a large number of complicated formulæ containing some of the "latest" remedies whose action may not be well understood.

The cases of eczema may be roughly divided into those that require soothing and those that need stimulating applications. In the most acute forms of the disease (vesicular) the saturated solution of the boric acid or zinc oxide in lime water (1 to 5) or the calamine and zinc lotion will give relief. The very acute stage of eczema is of short duration, and soon passes into the form where soothing, protective, and slightly astringent remedies are indicated (typified by the Lassar paste). In attempting to decide when a certain case of eczema has reached the point where stimulation is necessary a considerable amount of caution should be observed. At this stage it is advisable to add a small amount of tar or other stimulant (2 to 5 per cent.) to the zinc oxide ointment or paste. If the patient improves under this treatment we can increase the strength of the stimulating remedy. In some cases ichthyol and resorcin will be preferred to tar. In the chronic and obstinate cases, with marked thickening of the skin and often verrucous changes, it will be necessary to employ the most vigorous stimulants, such as

chrysarobin (10 per cent. ointment in lanolin), frictions with green soap, strong salicylic acid (10 per cent. in collodion), and the *x*-rays.

It seems to be well understood that in the acute forms of eczema (particularly of the vesicular and oozing type) the use of water is injurious. In the chronic cases, especially the rebellious ones, the vigorous use of soap and water will often be followed by decided improvement. In order to remove the crusts, discharges, and ointment from an eczematous surface it is advisable to use a piece of muslin or cloth dipped in olive oil, with which the tender surface can be gently cleaned.

As the treatment of eczema on different parts of the body varies somewhat, it will be convenient to briefly discuss the regional therapy of the disease.

In eczema of the scalp associated with pediculosis the latter condition should receive immediate attention before we attempt to cure the eczema. Crusts are best removed by soaking the scalp in olive oil containing 2 to 3 per cent. of salicylic acid, or, if extremely adherent, by wearing an impermeable rubber cap over the head for a day or two. The continued daily application of a simple salicylated oil will cure many cases. In others it will be necessary to add a stimulant, such as tar. I prefer to use the oil of cade, 1 part in 16, increasing to 1 part in 4 if necessary. A 5 per cent. ointment of ammoniated mercury is also of value if one objects to the odor of tar. In chronic dry eczema of the scalp, benefit will result from shampooing with soap and water.

Eczema of the nostrils often occurs in debilitated and strumous individuals, and requires general tonic treatment—the administration of cod-liver oil, etc. Any existing nasal catarrh should receive proper treatment, crusts should be removed by a boric acid ointment, and the lesions treated with a 5 per cent. ammoniated mercury ointment.

When the eyelids are involved the possibility of an infection with pediculi pubis must be considered. When the surface of the lids is affected a simple zinc ointment can be applied. The best treatment for the edges of the lids is 1 per cent. ointment of yellow oxide of mercury. Epilation of the eyelashes may be necessary.

Eczema of the lips may be due to the habit of frequently moistening them with the tongue, or, at times, to the use of a dentifrice, and it will disappear when these sources of irritation are removed. Mild cases are to be treated with simple applications of camphor ice or painted with compound tincture of benzoin. The condition is often obstinate, and requires stimulants, such as Rosenthal's paste (see Sycosis), or painting with silver nitrate (10 per cent. solution), or even applications of pure carbolic acid.

Eczema of the palms is frequently very rebellious to treatment, and, on account of the thickness of the epidermis in this region, requires in all except the acute cases, vigorous stimulation. To cause a maceration of the thickened epidermis an excellent plan is to wear rubber gloves. For this purpose ordinary surgical gloves, or lineman's gloves, turned inside out, with the rubber next to the skin, will serve the purpose. They are most conveniently worn at night, while during the day stimu-

lating ointments of tar, salicylic acid, etc., are applied. Patients whose eczema is due to their occupation, but whose circumstances will not allow even temporarily stopping their work, should only wash their hands with soap and water at the end of the day's work. If this is done in the morning it removes the natural oily protection from the hands and renders them more vulnerable to external irritants. Before going to bed the hands should be dressed with some ointment, such as Lassar paste, diachylon ointment, etc. The following morning the hands should be cleaned with oil only, and during the day several applications of grease may be made with a salve pencil composed of cocoa butter, 4 parts; wax, 2 parts; and lanolin, 1 part (Walker).

In cases of subacute eczema of the legs, where there is not much exudation, an excellent dressing is afforded by the glycogelatin (see Varnishes). In addition to protection, they give a much desired support. Rest in bed will often be of benefit in such cases. In chronic, thickened eczema, vigorous soap frictions, or the application of pieces of vulcanized rubber cloth to the skin, will often have a remarkably good effect. Whether varices are present or not, it is advisable to exert an even pressure by a bandage applied from the toes to the knee.

Eczema of the nipples can be treated by any bland ointment, the nipples being gently washed with a little water or solution of boric acid after each nursing. Fissures can be painted with compound tincture of benzoin or treated with nitrate of silver stick. If the case is of recent origin one should think of scabies, while if the disease has persisted for a long time the possibility of Paget's disease should not be forgotten. Weaning is occasionally necessary.

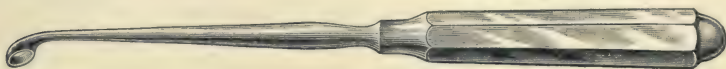
An acute eczema affecting the genitals or anal regions is treated like acute eczema of other regions. In the chronic cases that are so often intensely distressing the possibility of diabetes must not be overlooked. Ointments of tar, salicylic acid, and especially chrysarobin, are often of value in this region. Applications of hot water, as hot as can be borne, will often give temporary relief. Anal fissures, hemorrhoids, etc., must, of course, receive proper attention. I have seen some good effects from the use of both *x*-rays and the high-frequency current, though I do not think any more than temporary improvement was caused by either of these agents. In any case of eczema of the scrotum a suspensory bandage should be worn. When the skin is greatly thickened it is advisable to wear rubber tissue next to the skin, held in place by the suspensory bandage. Dressings for female patients should be held in place by a T-bandage.

Elephantiasis.—The best treatment for the filarial form of elephantiasis is to remove the patient from the region where filarial disease is endemic. The periodic attacks are to be treated by rest in bed and the administration of quinine. In the sporadic non-filarial cases it is wise to exercise scrupulous cleanliness in order to avoid attacks of erysipelas that often aggravate or even cause the disease. Any accompanying dermatitis or ulceration should receive appropriate treatment. Elephantiasis of the legs is to be treated by occasional rest, by massage,

and by firm support by elastic bandages and stockings. One of my cases has been considerably improved by excision of wedge-shaped pieces of tissue. Elephantiasis of the genitals is best relieved by surgical measures.

Epithelioma.—The treatment of epithelioma of the skin must be thorough and radical if it is to be followed by success. Extirpation, curettage, cauterization, and the use of the *x*-rays can all result in dire failure in the hands of timid and inexperienced operators. In cases of epithelioma of the mucous surfaces of the lips, penis, and wherever there is glandular involvement the proper treatment is extirpation by a competent surgeon. It is probably true that the majority of cases of epithelioma of the skin, whether superficial or deep, can be successfully removed by extirpation, although, according to Pusey, whose experience with this disease is extensive, the “danger of recurrence is greater after excision than after removal by *x*-rays or caustics.” At any rate, there are many patients suffering from the superficial form of epithelioma who would never consent to an operation, and who, as a matter of fact, can be entirely relieved of their affliction by other methods than the use of the knife. In the treatment of such cases it is my custom to rely entirely upon curettage followed by cauterization or upon the *x*-rays.

FIG. 62



Dermal curette.

The use of the curette alone will easily remove precancerous lesions, such as senile warts, and also beginning cases of superficial epithelioma. In the majority of cases I think it is advisable to thoroughly anesthetize the field of operation and to follow the vigorous use of the dermal curette (Fig. 62) by the application of a caustic. For this purpose I now use, as a routine procedure, acid nitrate of mercury, a caustic that has been strongly recommended by Sherwell, who has obtained excellent results from its use. While only moderately penetrating, it has the advantage of forming a protective crust which requires no dressing. If a deeper caustic action is desired, the raw surface can be treated for a few seconds with a solid stick of caustic potash.

While far from being overenthusiastic about the *x*-rays, I feel convinced that it is an invaluable remedy in epithelioma, by means of which we can often effect a cure after one or two months of treatment. In my experience I have found it necessary to produce an erythema, and am inclined to think the best results are obtained by pushing the treatment to the point of causing a lively dermatitis. It is true that some of my most lasting results have followed a second degree burn that required several months to heal.

The use of caustics alone in the treatment of epithelioma is not looked

upon with much favor at the present time. This is probably due to the fact that the method is generally painful, and that it is the one employed by advertising charlatans. My personal experience with caustic pastes containing arsenic, zinc chloride, caustic potash is very small, but I have no doubt that if vigorously and fearlessly used the excellent results that have been obtained by A. R. Robinson and others could be duplicated.

Erysipelas.—Erysipelas is a disease which runs its course and disappears spontaneously. In the severe cases the patient should be put to bed, given a fluid diet, free purgation, alcohol sponges, heart stimulants, etc.—in a word, suitable treatment for a severe febrile condition. Alcohol should be given if the patient, as so often happens, is addicted to its use. The case should be isolated, especially if the disease occurs in a hospital ward. The tincture of the chloride of iron can be administered in doses of 10 to 30 drops every three hours, according to time-honored custom. The local application of ichthyol in a 50 per cent. solution in water or simple ointment justly deserves its great popularity, in my opinion. It is efficacious even if not always agreeable. Another method that has given me much satisfaction is the employment of cold wet dressings of aluminum acetate at 60° F., and changed very frequently. This plan of treatment is only practicable when the patient can receive proper nursing. The cases of facial erysipelas as we see them in the clinic are generally mild and run their course without much disturbance to the patient. In erysipelas of the scalp the hair should be cut short, to facilitate the local applications. Opinions differ as to our power of limiting the spread of the eruption by painting the skin beyond the advancing border with iodine, collodion, silver nitrate, or by injecting a weak solution of carbolic acid. In the severe cases good results are reported by a few observers from the use of antistreptococcic serum. I have had no experience with this remedy. Excellent results have also been reported from the use of Hiss' leukocytic extract (see Furunculosis). At the conclusion of the illness the patient's clothing should be properly disinfected.

Erythema Exudativum.—The average attack of erythema multiforme of the erythematous or papular type runs its course and requires as little medical assistance as a case of chickenpox. No internal treatment is necessary, and a simple dusting powder or soothing lotion is all that is needed to quiet the slight sensation of burning that is generally present. In the rare cases accompanied by general febrile symptoms, rest in bed and the administration of salicin or aspirin are indicated, the action of the heart being carefully watched. In the bullous type of the disease it is well to use a boric acid or aluminum acetate lotion, and to allow the bullæ to remain unopened. The best treatment for erythema nodosum is rest in bed and the administration of salicylate of soda or one of its substitutes. To prevent recurrences of erythema multiforme it is necessary to pay attention to the patient's diet. If the tonsils are hypertrophied it is often advisable to have them removed. Arsenic may be given a trial.

Erythema Pernio (*Chilblain*).—In the treatment of this obstinate affection, prophylaxis is all important. The patient's circulation should be improved by vigorous daily outdoor exercise. At the approach of cold weather, woollen gloves and stockings and large loose-fitting shoes should be worn, and the patient should avoid getting the feet wet. The hands and feet should be frequently washed, rubbed vigorously, and dusted with an indifferent powder. In the first stages of pernio it is best to use a soothing remedy, such as the calamine and zinc lotion. The majority of cases, however, require stimulating applications to invigorate the circulation. Among the innumerable remedies suggested may be mentioned the tincture of iodine, used as such, or with plain collodion (1 to 10). The iodine-vasogen recommended by Crocker, or a 50 per cent. ichthyol ointment, may also be of value. Whatever remedy is chosen must be used with patience for a considerable period. Galvanism and faradism may be tried. If bullæ are present they should be treated by a wet dressing of aluminum acetate or boric acid.

Favus.—The treatment of favus is practically the same as that which will be later outlined for ringworm. Favus of the non-hairy parts can be readily cured by almost any parasiticide after a preliminary removal of the crusts by oils, wet dressings, etc. In the treatment of favus of the scalp there should be less hesitation in using the x -rays than in ringworm, as the disease is so often followed by permanent scarring, and, unlike ringworm, frequently persists long after the age of puberty.

Furunculosis.—A furuncle is a localized staphylococcic infection which always demands local treatment. In cases of chronic furunculosis, however, much good can be done by improving the general health and increasing the patient's resistance to the infection. It is in the treatment of furunculosis that some of the most brilliant results of vaccine therapy have been obtained. Theoretically we should only use the autogenous vaccines properly controlled by the opsonic index. As a matter of fact, however, I have seen excellent results from the use of stock vaccines, and can freely recommend that they be tried and controlled by the clinical symptoms obtained. Instead of the larger doses so often used I think it is preferable to begin with a dose of 50,000,000 of the killed cocci, repeating the injection every four or five days, and increasing the dosage as the clinical symptoms improve. I have never seen any benefit at all from the use of calcium sulphide, and have had no experience with the old-fashioned treatment with fresh yeast. Both of these methods have been largely discarded. In any case of furunculosis the examination of the urine for sugar and for albumin should not be neglected.

The local treatment of a furuncle should include an attempt to abort the lesion, to relieve pain, and to prevent infection of the surrounding skin. Probably the best method of aborting boils is by the use of carbolic acid in some form. A good plan is to epilate the central hair, if this is present, and to introduce a small drop of carbolic acid with a fine probe. The application of the carbolic acid and mercury plaster mull of Unna is a simple and effective method. Painting the lesion with

pure ichthyol or tincture of iodine are also successful at times. The common use of a poultice to relieve pain and bring the boil to a "head" should be condemned on account of its macerating the tissues and spreading the infection. Less objectionable than poultices are hot compresses of a weak (1 to 1000) solution of bichloride or carbolic acid (1 to 40). As soon as softening is detected the furuncle should be opened by a fine incision or by a sharpened toothpick dipped in carbolic acid and plunged into its centre. The lesion should then be treated on surgical principles, preferably by a wet dressing, to favor drainage. To lessen the spread of the staphylococci and the formation of new furuncles, strict cleanliness should be observed, and the skin should be frequently washed with alcohol or a solution of bichloride (1 to 1000). A paste containing 5 per cent. of salicylic acid may also prove of prophylactic value. In the obstinate cases occurring upon the neck the x-rays may be tried.

In furunculosis as well as in other staphylococcic infections good results are reported from the use of the leukocyte extract of Dr. Philip H. Hiss. This consists of a watery extract of leukocytes obtained from the pleural cavity of rabbits.

Herpes Zoster.—The indications for the treatment of herpes zoster are to prevent the rupture and subsequent infection of the vesicles by a protective dressing and to relieve the accompanying pain. The best protection is furnished by a layer of flexible collodion or of glycogelatin, although the application of a simple dusting powder is satisfactory. If the vesicles have ruptured and ulceration has occurred the best treatment is to apply a wet dressing and later a boric acid ointment. For the relief of the pain, which is often intense, the administration of morphine may be necessary. For the neuralgic pain, which often lasts for some time after the disease has run its course, the best plan is to use a metal roller attached to the negative pole of a galvanic battery. This should be applied daily for ten or fifteen minutes in the neighborhood of the patches. Good results are reported by Howard Morrow by freezing the painful areas and also the region where the nerve emerges from the spinal column. In severe cases, especially in old persons, it is often necessary to administer tonics, such as iron, quinine, and strychnine.

Hyperidrosis.—The treatment of hyperidrosis should include an attempt to improve the general condition of the patient by daily cold baths and by exercise and tonics rather than by the administration of any specific remedies. So high an authority as Crocker has, however, claimed to have derived great benefit from the use of precipitated sulphur in teaspoonful doses, given twice a day, and combined with astringents if too great purgation was caused. That the disease is often difficult to cure can be readily surmised from the local remedies that have been suggested for its treatment.

The form of hyperidrosis that chiefly concerns the dermatologist is that which affects the palms and soles and axillæ. A simple and frequently efficacious plan for moderate sweatings of the feet is to wash them night and morning and to dust into the stockings boric acid powder

containing 3 per cent. of salicylic acid. The stockings should be changed at least once a day, and large comfortable shoes should be worn. Any deformity, such as flatfoot, should, as Hardaway has suggested, be remedied by appropriate treatment. In some cases of hyperidrosis of the palms and soles, good results are followed by applications of a 1 per cent. solution of formalin or a 5 per cent. solution of chromic acid at intervals of two or three days. In hyperidrosis of the axillæ, temporary relief for several hours may be obtained by the application of hot water upon a cloth or sponge.

In the most obstinate cases of hyperidrosis of the feet it is advisable to try Hebra's treatment by diachylon ointment. This is smeared upon strips of cloth and applied to the feet (which have previously been washed and dried) and fixed with a bandage. The dressing is changed every twelve hours, but without using any soap or water. At the end of ten to fourteen days exfoliation has taken place and a cure often obtained. Instead of the diachylon ointment, a good preparation of which is hard to obtain in this country, Stelwagon uses as a substitute a tannic acid ointment (1 dram of tannic acid to 1 ounce of vaseline). Good results can also be obtained by the x -rays, used continuously and without the production of an erythema.

FIG. 63



Electrolytic needle holder and needle.

Hypertrichosis.—It is generally accepted that the best way of permanently removing superfluous hairs is by means of electrolysis, a method first used for this purpose by Hardaway. The necessary apparatus includes a galvanic battery giving a current of 2 to 3 milliamperes, a thumb forceps, needleholder (Fig. 63), and a suitable needle. For this purpose a fine flexible "jeweller's broach" or a fine iridoplatinum needle can be used. The hair that is to be removed is grasped by thumb forceps. The needle (which is attached to the negative pole) is introduced into the follicle in the direction of the hair shaft. The patient then completes the circuit by grasping a sponge electrode attached to the positive pole. The needle is held in place until the hair is perfectly loose and can be removed by gentle traction. Before the needle is withdrawn the patient's hand should be removed from the sponge electrode. In this manner an experienced and patient operator can destroy about fifty hairs in one-half to three-quarters of an hour, with a splendid cosmetic result and a small percentage of recurrences.

The use of the x -rays should, in my opinion, be unhesitatingly condemned, as in order to obtain permanent results it is necessary to give an enormous number of exposures, with the consequent danger of pro-

ducing telangiectasis and atrophy. A few bad results that I have seen would certainly deter me from using this method.

Hypertrichosis can be temporarily relieved by the use of a depilatory powder, such as 2 parts of barium sulphide and 3 parts each of starch and zinc oxide. This is made into a paste, with water, and applied to the skin for ten to twenty minutes until perfectly dry. It is then washed off with water. Superfluous hairs can, of course, be removed by shaving, although the action of shaving as well as depilatories is generally followed by a coarser growth of hair. Bleaching with hydrogen peroxide will often render a downy growth of hair less noticeable.

Ichthyosis.—The indications for treating ichthyosis are to remove the scales by soap and water and to supply the natural deficiency in fat by anointing the skin with some greasy application, such as vaseline, sweet almond oil, or glycerin. If the diseased process is rather severe, it may be necessary to use green soap and to add 5 per cent. or more of salicylic acid to the oil or ointment that is selected. In regard to the local use of drugs, I agree with Whitfield that the vehicle is "more important than the drug that may be selected." Pilocarpin has been used to increase the production of sweat and thyroid extract for its general effect upon the disease, although personally I do not care to use any of these methods of treatment. A residence in a warm climate is advisable when this is possible. At all events the patient may have the satisfaction of knowing that his affliction will tend to improve or even disappear shortly after puberty.

Impetigo Contagiosa.—The treatment of impetigo contagiosa is extremely simple. It is only necessary to remove the crusts by means of olive oil, vaseline, etc., and to apply a parasiticide, such as a 5 per cent. ointment of ammoniated mercury. Indeed, in many cases the application of the ammoniated mercury alone will soften and remove crusts and speedily affect a cure. It is advisable to continue the use of the ointment for several days after the disappearance of the lesions. In the unusual cases where the disease is fairly generalized a safer application would perhaps be a solution of bichloride (1 to 5000). In impetigo contagiosa of the beard the patient should be advised to shave every day. To prevent reinfection the shaving brush and soap should be discarded and a shaving cream used in their place. The presence of the disease upon the back of the neck, especially in young girls, is generally secondary to pediculosis capitis.

Keloid.—The most satisfactory and, indeed, I may say, the only satisfactory treatment of keloid is with the x-rays or radium. I can only speak from experience of the former method. The treatment is slow and requires much patience. The benefit obtained from scarification, electrolysis, and the continued application of a mercurial plaster is never very great. Injections of thiosinamin have been recommended by Tousey and others. I have recently seen improvement from subcutaneous injections of fibrolysin made at the border of the lesion. Extirpation, as is well known, is invariably followed by relapse, and generally in an aggravated form.

Lentigo and Chloasma.—The object to be attained in removing freckles or patches of chloasma is to cause a superficial exfoliation of the epidermis, and with it the pigmented rete cells. For this purpose the most satisfactory application is a solution of bichloride of mercury (1 to 500 up to 1 to 2000), applied several times a day to the face until peeling occurs. The same object can be obtained by the use of a 10 per cent. resorcin paste allowed to remain on the skin twenty-four hours. I have never had any success in trying to bleach out the color with hydrogen peroxide. For dark freckles, Hardaway and Grindon employ superficial electrolysis. As a prophylactic against freckles the patient should be advised to wear gloves and a brown or red veil. In the treatment of chloasma an attempt should be made to remove the cause, if, indeed, any cause can be ascertained.

Leprosy.—Leprosy is, in my opinion, a mildly contagious disease, which is carried from one person to another and which can only be stamped out of a community by strict segregation. I am inclined to think that the increasing number of lepers in New York (I have seen more than thirty cases in this city during the past year) will sooner or later make some system of isolation necessary. While I do not think that the presence of a moderate number of lepers in a climate such as that of New York should be a cause of great alarm, I feel that it is proper to segregate at least the more advanced cases of the disease. This would not be a great hardship if the patients were to be provided with such cheerful surroundings as are found at the Leper Home in Louisiana.

While leprosy is fatal in the majority of cases, its progress can often be checked for many years by proper hygienic and medicinal treatment. Indeed, in a certain small proportion of cases the disease runs its course and can be said to be cured. The general management of leprosy is similar to that of pulmonary tuberculosis, and should include strict cleanliness, a nutritious diet, and, if possible, an out-of-door life. There are two drugs, chaulmoogra oil and strychnine, that enjoy a well-deserved reputation in the treatment of leprosy. Chaulmoogra oil is best administered in capsules or milk of magnesia, in initial doses of 3 drops taken before meals and increased to the point of toleration. As much as 150 drops have been given at a dose. Strychnine, according to Isadore Dyer, of New Orleans, "is a *sine qua non* in the treatment of leprosy." Indeed, the same authority writes: "That a leper should always take strychnine, the dose to be regulated by the patient himself." The results obtained by the use of Carasquilla's serum, by "Leprolin," and Nastin have all proved disappointing. Crocker has seen benefit from intramuscular injections of calomel, and Dyer has had favorable results with the use of Calmette's antivenene.

The local treatment of leprosy is of minor importance. I have seen the tubercles flatten under x-ray treatment and under the use of reducing agents such as resorcin and chrysarobin, and in cases of tuberculous leprosy would advise a trial of both of these methods. Any ulcerated surfaces are to be treated on general surgical principles.

Lichen Planus.—In the management of lichen planus, especially the generalized and severe forms, it is of importance to improve the general condition of the patient by hygienic and tonic measures. In obstinate cases a complete rest or change of scene are of great assistance in bringing about a cure. For the relief of itching, which varies greatly in different cases, a soothing and antipruritic remedy, such as calamine and zinc lotion, is to be prescribed. In addition the alkaline and emollient baths may be found useful.

Arsenic has long been regarded as a specific in lichen planus, excellent results having been obtained from its administration. The use of mercury has in recent years somewhat taken the place of arsenic. In my practice it is used as the routine method of treatment, as its administration is quicker and simpler than that of arsenic and its results seem to me fully as beneficial. Indeed, some have supposed that there was a relationship between lichen planus and syphilis from the brilliant results attained at times from the use of mercury, a conclusion which is, however, entirely unwarranted. It is my custom to prescribe the protiodide of mercury in the form of $\frac{1}{4}$ grain tablets, three times a day, although other preparations of mercury are probably equally efficient.

The local treatment of lichen planus, with the exception of the chronic patches, to be later considered, is very unsatisfactory. From my own experience I can verify the oft-repeated statement of my father that there is no inflammatory disease of the skin whose course is so little influenced by local treatment as is that of lichen planus. While the various preparations of tar are recommended in the majority of textbooks for their local effect upon the disease, I cannot see any particular value beyond their ability to lessen pruritus.

It is in the treatment of the chronic, rebellious patches that local remedies are not only valuable, but absolutely necessary. This form of the disease is to be treated like obstinate patches of eczema or psoriasis by an ointment of chrysarobin (20 per cent.) or by equal parts of oil of cade, alcohol, and *sapo mollis*, vigorously rubbed into the skin. If the patches are covered by thick, horny masses, they can be treated at first by a 20 per cent. salicylic acid plaster or a saturated solution of salicylic acid in collodion. Cases that cannot be cured by these remedies will generally yield to *x-ray* treatment, while the extremely obstinate patches can be removed by touching them lightly with the Paquelin cautery.

Lupus Erythematosus.—There is hardly any disease of the skin whose treatment is at times so unsatisfactory as that of lupus erythematosus. This peculiar and obstinate affection is no exception to the rule, as James C. White has pointed out, that the "curability of a disease is in inverse ratio to the number of remedies that are recommended for its cure." The number of remedies suggested for lupus erythematosus and the results from the use of any particular one differ greatly in the hands of different observers. This is largely due to the fact that in some cases there is a tendency to spontaneous cure, while in others the disease persists in spite of all treatment. The course of lupus erythematosus can rightly be termed capricious. We are entirely ignorant of

the cause and true nature of the disease, and our treatment is wholly empirical. A number of remedies have been suggested for internal administration, the best results having been obtained from quinine and salicin.

The local treatment of the cases that are congested and show a tendency to spread should consist of soothing remedies, such as the calamine and zinc lotion. Greasy applications should preferably be avoided. The remedy that is chosen should be patiently tried for month after month if necessary. The general rule is to begin with the mildest remedies and to give nature a chance to effect a cure, which she does at times with the least possible scarring. In cases that show no tendency to increase and that are infiltrated, scaly, and "fixed," stimulating or even destructive measures are necessary. I have seen good results from the long-continued use of a concentrated solution of "lotio alba," using as high as 6 drams each of the zinc sulphate and sulphuretted potash to 4 ounces of water. Good results have been obtained by frequent applications of pure alcohol and by painting the patches with non-flexible collodion. In the hands of certain French observers very brilliant results have followed the daily use of the high-frequency current extending over a period of a couple of months. Opinions differ as to the value of phototherapy, and especially the *x*-rays. Their usefulness in this disease is far less than in lupus vulgaris. I have personally never seen any good results from the use of the *x*-rays in lupus erythematosus. In the deep-seated and obstinate patches the best plan, in my opinion, is a vigorous curettage followed by cauterization with carbolic acid. For such cases the galvanocautery may be used, although the resulting scars are more disfiguring than those produced by the curette.

Lupus Vulgaris.—To obtain a permanent cure of lupus vulgaris it is necessary to completely destroy every vestige of diseased tissue. In the case of small patches which do not involve the mucous membranes and which are accessibly located, this is best accomplished, in my opinion, by excision with a wide and deep margin. In the average case of lupus, which is too extensive for excision, we have to rely upon the Finsen light, *x*-rays, or some of the other methods that have long been in use.

For certain cases of lupus that do not involve the mucous membranes, and that present little or no scarring and no ulceration, there is no doubt in my mind that the Finsen light is the ideal method of treatment. This opinion is based upon the cases that I have seen at Copenhagen and upon the splendid reports from the Finsen Institute of that city. The advantages of this method are that it is practically painless, entirely safe, and produces the most perfect cosmetic results. Unfortunately the treatment involves the use of an expensive apparatus, the presence of skilled attendants, and involves a great loss of time. The only Finsen apparatus in which I should have any confidence is the original large lamp and the smaller one devised by Finsen and Reyn.

As the Finsen treatment is not accessible to many patients in this country, it is necessary to use the *x*-rays, which are a fairly good substi-

tute, or fall back upon one of the older methods, such as curettage and cauterization. X-ray treatment is especially useful for areas of large extent, and should be pushed to the point of producing a dermatitis. The best of the older methods, in my opinion, consists of vigorous curettage under an anesthetic, followed by the application of a caustic, such as a strong ointment (25 to 30 per cent.) of pyrogallie acid. This is renewed daily for several days, and followed by a simple dressing until healing has taken place. It is then necessary to attack individual nodules, some of which will invariably have eluded previous treatment. This is best accomplished by boring out each nodule with a dental burr dipped in carbolic acid, a method first recommended by my father. In my practice I operate the burr with a motor, although it may be used as well by the hand.

Personally, I have had no experience in the use of tuberculin, a remedy that is recommended by Whitfield and by Walker. The latter has obtained good results by the use of tuberculin (T R), given once a month in a dose of $\frac{1}{2000}$ mg.

Lupus of the mucous membrane is best treated by cocainizing the surface and applying the galvanocautery or a 50 per cent. solution of lactic acid.

Nevus.—The two best methods for treating nevi in general are electrolysis (discussed under Hypertrichosis) and freezing by liquid air and carbonic acid snow. In the latter agent, suggested by Pusey, we have a fairly good substitute for liquid air, a substance that is practically unobtainable at the present time. The snow can be readily collected from an ordinary soda-water tank in an apparatus such as that devised by Dr. S. Dana Hubbard and moulded into sticks of convenient size. Its action is, however, neither as deep nor as rapid as that of liquid air.

Small pigmented nevi are best removed by electrolysis. Larger coin-sized pigmented and hairy lesions can either be surgically excised or treated by snow or electrolysis.

Electricity or the application of a tiny drop of nitric acid will also readily cure the so-called spider nevus (*nævus araneus*). The treatment of *nævus vascularis* (the ordinary port-wine mark) is unsatisfactory. Its appearance can, however, be somewhat improved. This can be done by electrolysis or by gradually stippling the surface with nitric acid. The appearance can also be improved by the use of the snow applied for a minute and a half, with firm pressure, the process being repeated a number of times.

In the cavernous angioma the snow will completely destroy the redness, but will not have very much effect upon the swelling. This is best treated by electrolysis, with the use of a stiff needle. I have also seen good results in the hands of Dr. Semken at the Skin and Cancer Hospital, from Wyeth's method of injecting 10 to 60 drops of hot water (180° to 200° F.) at intervals of three to four days. Good results have also been obtained by Wickham and others with the use of radium. In the case of angiomata it is perhaps as well not to be too radical, as nature may ultimately effect a cure, much oftener, I think, than is generally

supposed. In support of this view it is only necessary to call attention to the frequency of angiomata in children in comparison with that of adults. In the case of the port-wine mark there is no spontaneous tendency to disappearance.

Pediculosis.—The indications for treating pediculosis of the scalp are to destroy the pediculi, remove the ova, allay irritation, and prevent reinfection. Before instituting treatment it is advisable in little girls to cut the hair short. In the case of older children or women this is never necessary, except in rare cases, where the hair has become hopelessly matted and tangled.

In the average case the presence of numerous excoriations and crusts is no contraindication to the immediate institution of treatment. It will be found that the symptoms of irritation will disappear with surprising rapidity as soon as the pediculi are killed. It is only in the most aggravated cases that a preliminary treatment with ammoniated mercury for several days is advisable.

The following routine plan is entirely satisfactory for dispensary practice, where, indeed, most of the cases of pediculosis are encountered. The entire scalp is thoroughly soaked with equal parts of kerosene and olive oil by means of cloths wrapped about the head in the form of a turban and covered by a rubber bathing cap or other impermeable material. The dilution of the kerosene oil lessens its inflammability and its irritating qualities as well. The oil is left upon the scalp from twelve to twenty-four hours, after which, in spite of the presence of crusts, the scalp is thoroughly shampooed with soap and water. By this time the pediculi have been destroyed, and it remains to remove the ova by using a fine-tooth comb and by pulling the individual strands of hair with a hot towel moistened with vinegar. This process requires some patience, and must be repeated for a number of days or even weeks. The dermatitis and adenopathy that have resulted from scratching will generally rapidly subside, though it often is necessary to use zinc oxide ointment for eczematous patches upon the nape of the neck. In private practice a more agreeable plan of treatment is to shampoo the head with soap and water and apply the tincture of delphinium or a solution of bichloride of mercury, 1 to 500, and repeat the application for two or three days. To prevent re-infection, old hats should be relined or subjected to a baking process or, better, discarded.

The treatment of pediculosis pubis does not require shaving of the pubic hairs in any case, although it is impossible to prevent some patients from resorting to this procedure. The best method of destroying the pediculi pubis is to wash the parts thoroughly with soap and water and apply a strong bichloride lotion (1 to 250), and repeat the treatment upon several successive days. The common practice of using blue ointment should be discouraged, as it is apt to be followed by a pustular folliculitis or at times a severe dermatitis. Pediculosis of the axillary region or of the eyebrows due to the presence of the pubic louse is treated in the same manner as the pediculosis pubis. When the parasite finds its way to the eyelashes it is best removed by means of thumb forceps.

To cure a case of that most intensely pruritic of skin diseases, pediculosis corporis, it is only necessary, as a rule, to thoroughly disinfect the clothing. This can be accomplished by boiling at least twice all of the cotton and linen clothing and bedclothing and baking all of the woollen garments. While the pediculi and their ova live, as a rule, in the seams of the clothing, the ova are occasionally found attached to the lanugo hairs. It is therefore best to direct the patient to take a bath of soap and water and anoint the skin with a weak (3 per cent.) carbolized ointment or oil, which will be soothing to the skin and, at the same time, provide an uncongenial atmosphere for the pediculi. As so many cases of pediculosis corporis occur among the vagabond class who possess but one set of clothing and no means of sterilizing them, we are often unable to do more than advise the patient to sprinkle powdered sulphur along the seams of the clothing and to prescribe a soothing ointment or lotion for the skin.

Pemphigus.—Pemphigus is a disease in which attention to the general health is all important. By such means alone can we hope to lessen or prevent the attacks. The administration of arsenic has been followed by good results in some cases and by failures in others. Salicin has been recommended by Crocker and strychnine by Neisser.

The local treatment consists in protecting the skin, allaying the irritation, and preventing infection. In all except the mild attacks the patient should be put to bed. Bullæ are to be carefully opened by a sterile needle, though if they are infected it is best to remove the entire roof with scissors and to apply aristol or an indifferent powder. Where the eruption is profuse and there is much crusting it is advisable to give the patient frequent prolonged warm baths, which will aid in removing crusts and lessen the bad odor from the discharges. The dressings may consist of a dusting powder or a soothing lotion or ointment. In the severest cases it is wise to keep the patient in the continuous bath, a method that involves a good deal of labor on the part of the attendants. If the patient is kept in bed he can be rendered more comfortable by lying upon a water-bed. In severe cases the hair should be cut to facilitate treatment of the scalp. Ruptured bullæ of the mucous membranes are best treated by an alkaline mouth wash and the application of tincture of iodine.

Pityriasis Rosea.—Pityriasis rosea is a self-limited disease, which runs its course, as a rule, in six or eight weeks. Its importance would be very slight if it were not for the fact that it is frequently mistaken for the macular syphilide. Moderate itching is often present, and should be treated by some soothing remedy, such as the calamine and zinc lotion. While some authors suggest the use of ointments, I should prefer to suffer from such an inoffensive disease as pityriasis rosea than to have my skin anointed with grease.

Prurigo.—Prurigo is a disease that requires a general medical supervision if not active treatment for many years. The great value of proper hygiene and a liberal dietary are shown by the improvement in some of the bad cases that are imported to this country. The local

treatment consists in frequent warm baths and the application of antipruritic and stimulating remedies, such as beta-naphthol, tar, and sulphur. There is no better method of treatment than the one recommended by Kaposi. This consists of inunctions every night with a 5 per cent. naphthol ointment (using half strength for children) and a warm bath every other night, using naphthol-sulphur soap. This is to be kept up until the eruption disappears. It is to be renewed whenever the disease recurs. In well-marked cases good results are obtained by green soap and water, or daily applications of the Wilkinson salve, whose formula is as follows:

R—Sulphuris præcipitati	3iss	12.0
Olei rusci	f 3iss	12.0
Cretæ præparata	gr. xl	5.0
Saponis mollis	3iiss	20.0
Adipis q. s. ad	5j	100.0—M.

Sig.—External use.

Pruritus.—Pruritus is due in most cases to the presence of toxic agents or irritants in the skin. It is, in brief, a nervous phenomenon of toxic origin. It is a prominent symptom of various diseases of the skin, such as eczema, urticaria, scabies, pediculosis, lichen planus, etc., and is frequently present where there are no apparent lesions of the skin. The proper treatment of this symptom requires at times a painstaking study of the various organs, careful urine analysis, etc. It may at times be relieved by a careful diet or by abstinence from alcohol, tea, coffee, and tobacco. Woollen underwear is sometimes at fault, and must be replaced by material of linen, cotton, or silk. Baths and, as Laredde has pointed out, the too frequent use of soap may be the cause of pruritus. Very little can be done, as a rule, to relieve itching by internal administration of drugs. Morphine should always be avoided, as it may of itself cause pruritus.

There are two classes of local antipruritic remedies—those that stop itching permanently by removing the cause of the disease, and those whose effect is only to give temporary relief. In the former class are included the stimulating (reducing) remedies, such as tar, sulphur, resorcin, and chrysarobin. Soap and salicylic acid may also indirectly act as antipruritics in cases where a keratolytic action is indicated. The temporary antipruritics act upon the nerves by emitting vapors which are absorbed by the skin. They include carbolic acid, menthol, camphor, acetic acid, and guaiacol. Carbolic acid is preferably used in an oil or salve in a concentration of 3 to 10 per cent., and acts upon both inflamed and normal skin. It is, however, at times irritating, and if used over a large surface may cause poisoning from absorption. Itching may also be relieved by alkaline baths, by the application of ordinary vinegar, or alcohol, or extremely hot water to the skin. Spraying chloroform upon a localized area is often of the greatest value. There can also be no question of the antipruritic power of both the high-frequency

current and the α -rays. The following are some useful formulæ for pruritus:

R—Acidi carbolic	3ss	4.0
Glycerini	3ij	2.0
Alcoholis	3j	15.0
Aquæ	Oj	100.0—M.
Sig.—External use.		

Bronson's antipruritic lotion:

R—Acidi carbolic	3ij	20.0
Liquoris potassæ	3j	10.0
Olei lini	3j	100.0—M.
Sig.—Shake. External use.		
R—Mentholis	3j	10.0
Olei amygdalæ dulcis	3ij	20.0
Lanolini	3j	100.0—M.
Sig.—External use.		

Psoriasis.—The true cause of psoriasis, like that of so many affections of the skin, is still entirely unknown. The tendency at the present time seems to be to consider that it is due to some local infection. At all events, much more reliance is placed upon local treatment than was formerly the case. The wisest plan, in my opinion, is a combination of general and local therapy, as in psoriasis we are dealing with an obstinate affection that frequently taxes all of our therapeutic resources.

The general condition of the patient should always be improved where this is possible. It is true that many psoriatics are strong, robust, and apparently the picture of health. Upon careful examination of each case it will often be found that the patient is not, as a matter of fact, in perfect health, and that his psoriasis will improve if he is put into rigid training. Any obvious departure from the normal condition, such as a rheumatic tendency, anemia, etc., should be corrected by appropriate measures. In the majority of cases it will be found that too much meat is consumed. The strictly vegetarian diet advocated by many is often of great value. On the other hand, some cases of psoriasis have been cured on a diet consisting of meat alone.

Of all the internal remedies that have been used for psoriasis, arsenic is the only one that seems to have stood the test of time. Its action, however, in this disease is very capricious, causing benefit in some cases and actual harm in others. It may even act differently in the same patient in the treatment of different attacks. It should never be used during the acute stages of the disease, when the patches are congested and when the eruption is spreading. As the action of arsenic is slow, it should be continued, if well borne, for several months. It is most conveniently administered in the form of Fowler's solution, beginning with a dose of 3 drops, three times a day, increasing to 10 drops and temporarily stopping or lowering the dose at the first sign of toxic symptoms. Other methods of administration can be used and have already been discussed (see page 758). The value of arsenic in preventing future attacks of psoriasis is very doubtful. In fact, nothing can with any certainty prevent the recurrence of the disease.

Space will not permit a discussion of the numerous other remedies that have been tried and recommended for psoriasis, including potassium iodide in heroic doses, salicin, thyroid extract, carbolic acid, turpentine, tar, etc., none of which have proved of great value. In the early stages of psoriasis it is often possible to lessen the congestion by prescribing one of the alkalies, such as acetate of potash, in 15 drop doses, three times a day, before each meal.

There are two indications for the local treatment of psoriasis—namely, to remove the scales and to apply stimulating (reducing) remedies, which will cause absorption of the inflammatory exudate. The scales of psoriasis are often removed, with comparative ease, by a warm bath in which soap, especially the *sapo mollis*, is freely used. Indeed, some of the mild cases can be cured alone by a daily bath of soap and water, followed by the inunction of some simple ointment, such as vaseline or lard. When the scales are more firmly attached it is advisable to add an alkali (see page 763) to the bath and to vigorously scrub the skin with a stiff brush. Another method of removing the thickened scales of inveterate patches is to wear an impermeable rubber garment next to the skin with a layer of cloth interposed to lessen irritation.

After the preliminary removal of the scales or in many cases without such preliminary treatment the active antipsoriatic remedy should be rubbed into the patches. The drug which is preëminently valuable for this purpose is chrysarobin, which in spite of its disagreeable features has almost entirely replaced other remedies, such as tar, pyrogallie acid, beta-naphthol, mercurial preparations, and sulphur. Chrysarobin was originally recommended to be used as an ointment, and the fact still remains that the drug is most active if used in this form. In the average case I use a 10 per cent. ointment in a base of equal parts of vaseline and lanolin upon the trunk, while a 20 per cent. or even 30 per cent. is readily tolerated upon the extremities. During a course of treatment with chrysarobin the patient should be instructed to avoid bathing in order to lessen the severity of the resulting dermatitis. It should be said at this point that the dermatitis seems to be a necessary accompaniment of chrysarobin therapy, the beneficial effects only resulting when the surrounding normal skin has been stained a mahogany red. If a complete removal of the patches, as shown by their assuming a white appearance, is not attained by the first course of inunction, it is necessary to anoint the skin with cold cream or a zinc ointment and to repeat the treatment after the dermatitis has subsided. On account of the staining of the skin and the danger of conjunctivitis that has already been discussed (see page 772), chrysarobin should not be used upon the face or scalp. For this purpose the best results are attained by the employment of a 10 per cent. ointment of ammoniated mercury.

On account of its disagreeable qualities of staining any of the clothing with which it comes in contact, chrysarobin is often given in the form of a collodion varnish, although its action in this form of application is less powerful. For localized patches it can be given in collodion or in a

saturated solution of chloroform, which leaves a layer of powdered chrysarobin on the patches after the chloroform has evaporated. A protective film of collodion or traumaticin is then poured over the patches and the process renewed every few days as the films become loosened. The exhibition of chrysarobin in ointment form can also be rendered less disagreeable by applying it to the skin and covering it with pieces of surgical rubber tissue.

In the treatment of small circumscribed patches of psoriasis, such as those upon the elbows and knees, a good method of treatment is to use a 10 per cent. ointment of pyrogallie acid. The staining caused by this remedy and the possibility of its causing toxic symptoms have been already discussed (see page 769).

Purpura.—The treatment of purpura is purely symptomatic, as we are in ignorance as to the real cause of the disease. It is difficult to judge of the value of any special form of internal medication, as the affection generally tends to spontaneous cure. In the very mild cases no treatment is needed, although on general principles we prescribe iron and ergot internally. In the cases of purpura rheumatica and in the alarming hemorrhagic form of the disease, absolute rest in bed is imperative and of far greater value than any medication. The diet should consist at first of milk, and as the patient improves should be more liberal and nutritious. Quinine should be given in large doses in the cases associated with malaria. In the cases accompanied by rheumatic pains in the joints, we would naturally prescribe the salicylates or their substitutes, although Osler advises arsenic pushed to the limit of toleration. In severe cases I should try ergotin subcutaneously and gelatin by mouth or per rectum. To increase the coagulability of the blood, Wright has suggested calcium sulphide in 30 grain doses, three times a day, to be given for several days. Granville McGowan recommends adrenalin in 10 drop doses, given every two hours by mouth or subcutaneously. For the relief of hemorrhages from the mucous membranes we can use tampons or irrigations of a (1 to 5000) solution of adrenalin. In the severer cases Besnier advocates bandaging the legs. No local treatment for the eruption is necessary.

Rosacea.—The general treatment of rosacea is very similar to that of acne, with the exception of the special measures required to remove the dilated vessels and the connective-tissue hypertrophy. In rosacea it is even more necessary to supervise the patient's diet and to relieve constipation and dyspepsia. A hard-and-fast rule is to prohibit the use of all food and drink that causes flushing of the face. It is practically useless to rely upon any internal medication, in my opinion, although Unna and others have strongly recommended ichthyol, and think that it contracts the vessels of the face even when internally administered.

The local treatment is practically that described under acne, and consists in the use of stimulating remedies, such as soap, sulphur, the acne curette, and of the exfoliative pastes of resorcin, salicylic acid, etc. The dilated vessels are best treated by means of electrolysis (described under the subject of Hypertrichosis). The needle is inserted into the

most prominent part of the vessel, preferably at the root of several branches, and allowed to remain from ten to thirty seconds. Although the telangiectases can be satisfactorily destroyed in this way other vessels will continue to enlarge and become varicose unless the cause of the disease is removed. For the treatment of red noses showing a slight connective-tissue hypertrophy or a number of pustules crowded together, good results are followed by multiple scarification by a series of parallel incisions. If desired, a second series of incisions may be made obliquely or at right angles to the first. Bleeding should be encouraged by bathing the nose with warm water for ten minutes or more. When superficially performed the small operation of scarification should not be followed by scarring, and can be repeated at weekly intervals.

FIG. 64



Scarifying knife.

In the case of the large pendulous and hypertrophied noses the larger masses can be excised and the entire nose literally pared down with a knife until it is of normal proportions. Such an operation may cause alarming hemorrhage, which, however, is readily controlled by pressure. No skin grafting is necessary, as the epithelium grows from the remains of the hypertrophied sebaceous glands. Good results have been obtained by some authorities with both *x*-rays and phototherapy. I have however, already expressed my disinclination to use the *x*-rays upon the face in diseases that can be cured by other methods.

Sarcoma.—As a prophylactic measure it is advisable to excise or thoroughly destroy any pigmented mole that is exposed to constant friction and irritation. Radical wide excision may cure a non-pigmented sarcoma or a melanosarcoma (more properly termed melanocarcinoma). When generalization has occurred it is best not to attempt any operative procedure. As a forlorn hope in such cases we should give arsenic internally and apply the *x*-rays locally. I have recently seen marked improvement under *x*-ray treatment in a case of melanoma presenting a hundred or more small tumors of the foot. In a few cases the injection of Coley's fluid, consisting of a mixture of the toxins of streptococcus and *Bacillus prodigiosus*, has been followed by cures. In the slow-growing hemorrhagic sarcoma of Kaposi the *x*-rays should always be tried.

Scabies.—The treatment of this common affection of the skin is simple and satisfactory. The objects to be attained are the destruction of the scari, the relief of the irritation of the skin produced by scratching, and the prevention of reinfection of the patient. Of the numerous antiparasitic remedies that can be used to destroy the acari there is none which is more efficient or rapid in its action than sulphur. This can be used as the ordinary unguentum sulphuris of the *Pharmacopœia*,

containing 15 per cent. of sublimed sulphur. In the case of children or persons with an eczematous tendency it is necessary to use sulphur ointment in half the usual strength, or it can be combined with balsam of Peru, as in the following ointment:

R—Sulphuris sublimati,				10.0
Balsami Peruviani	. . . . .	āā	3ij to vj	10.0
Adipis benzoinati,				40.0
Petrolati	. . . . .	āā	ad 3iv	ad 100.0—M.
Sig.—External use.				

Other remedies, including styrax, stavesacre, beta-naphthol, have had their adherents and are all capable of curing scabies.

The following routine plan of treatment is, I think, best suited for dispensary practice, and for many private cases as well. The patient is directed to take a warm bath at night for half an hour, during which time the skin, especially where there are lesions, is vigorously scrubbed with soap. If the case is one of long standing, or if the skin is not particularly delicate, it is best to use the *sapo mollis*. Particular attention should be given to the favorite sites of scabies, including the finger webs, wrists, axillæ, nipples in women and genitalia in men, umbilical region, and internal aspect of the thighs. A stiff brush should be used in cases where the epidermis is thickened and tough. By means of the keratolytic action of the soap the epidermis is softened and the burrows of the itch mite opened up and rendered more accessible to the ointment. After the bath the patient should be dried with a towel and the antiparasitic ointment vigorously rubbed into the regions above mentioned, and, in addition, wherever there is any evidence of scratching. A light-fitting suit of woollen underclothes should be put on and worn until the treatment is completed. On the morning and night of the two following days the skin should again be rubbed with the ointment, without, however, any preliminary bath. On the fourth day a cleansing bath of soap and water is to be taken and the underclothing and bed-linen are to be changed.

One such course of treatment, if intelligently and vigorously carried out, will generally effect a cure, relief from itching being obtained after one or two inunctions. If there is any itching at the conclusion of the treatment it is to be relieved by soothing remedies, such as the calamine and zinc lotion, zinc oxide ointment, etc., as such itching is frequently due to the irritating effects of the drug and not to any remnants of the disease itself. At the end of a week, if there are still evidences of scabies, it will be necessary to repeat the three days' course of inunctions.

To prevent a reinfection of the patient it is necessary to boil all linen or cotton clothing, as well as bedclothing, and to bake or press, with a hot iron, all woollen material that has come in contact with the skin. It is, of course, useless to treat one member of a family suffering from scabies without treating the others at the same time.

A cleanly though somewhat slower method of treating scabies has been devised by Dr. Samuel Sherwell, of New York City. Following a bath

the body is lightly rubbed with washed sulphur, a small amount of the same remedy ($\frac{1}{2}$ dram) is sprinkled between the sheets, and the under-clothing and bedclothes changed every two or three days. After a week or ten days of this treatment the patient is generally free from his disease.

Sycosis Vulgaris.—The treatment of sycosis is chiefly local, although it is true that in the severer cases much benefit will often result from an improvement in the patient's general condition. The rationale of the treatment is to cause an epilation which allows a free drainage of the follicles and a more favorable opportunity for the introduction of parasiticide remedies. An ideal epilation is easily caused by the x -rays, an agent which I should most warmly recommend in all except the acute or very mild cases. In the average case a cure can often be obtained by this means in from six to twelve exposures.

In the acute stage of the disease it is well to prescribe a soothing lotion of boric acid or zinc oxide. Any crusts that are present should be removed by olive oil or boric acid ointment. If the x -ray treatment is not used it is advisable to have the patient shave every day, or at least every other day, a procedure which is painful at first, but soon becomes bearable. The hairs should also be epilated from the centre of the pustules, where this does not occasion too much discomfort. In addition, the patient should rub into the affected area an ointment containing a parasiticide, such as sulphur or mercury. The following formula suggested by Rosenthal has been used with considerable success:

R—Acidi tannici,	
Sulphuris præcipitati	āā gr. xlv
Zinci oxidi,	
Amyli	āā ʒss
Petrolati mollis	ʒj—M.
Sig.—External use.	

In the very severe infiltrated cases the treatment is similar to that of a chronic eczema, and should include the use of soap frictions and strong reducing remedies. Curettage in such cases is often of benefit. Among the newer methods of treatment should be mentioned vaccine therapy, which has been used with benefit by Gildersleeve, Schamberg, Walker, Whitfield, and others, using autogenous preparations.

Trichophytosis.—It has often been remarked that the ease with which ringworm of the non-hairy parts can be cured is only equalled by the difficulty experienced in treating ringworm of the scalp. Upon the non-hairy regions the fungus is situated superficially in the epidermis, and can be easily reached and destroyed by applying any parasiticide ointment. My personal preference for these cases is the ordinary white precipitate ointment in a 10 per cent. strength. In the cases of *tinea cruris*, *e. g.*, ringworm affecting the scrotum and perineal regions, it is often necessary to precede the use of the parasiticide by scrubbing the parts with green soap and water. In some of the obstinate cases affecting this region I have obtained the best results by using either the iodine and goose grease, to be later mentioned, or a weak (3 to 5 per cent.) chrysarobin ointment.

sible, sleep in a separate bed and use individual brushes, combs, towels, toilet articles, etc. The case can be considered cured when, after complete discontinuance of treatment for three weeks, there are no broken hairs and no scaling to be seen, and a microscopic examination of the hairs fails to reveal the presence of the fungus.

Ringworm of the beard may appear as a superficial form similar to that of the non-hairy parts, in which case a cure is easily effected by any parasiticide ointment. In the more common kerionic or lumpy form a cure is also not difficult to obtain, as the hairs are rather easily epilated. The best treatment in my opinion is by the *x*-rays. Satisfactory results are also followed by mechanical epilation and the application of the iodine and goose grease or other parasiticide ointment or lotion.

Ringworm of the nails is an extremely rebellious affection to treat. In this rather unusual form of the disease the *x*-rays, applied until the nails are shed, is in my opinion the method of choice. The cases can be cured, however, by scraping the nails with a piece of broken glass, applying a drop of caustic potash, and then soaking them in a strong solution (1 to 250) of bichloride of mercury for ten minutes, the procedure to be repeated several times a week. A cure can also be obtained by constantly wearing a 10 per cent. salicylic acid plaster upon the nails.

FIG. 65



Piffard's epilating forceps.

Urticaria.—An acute attack of urticaria is easily relieved, as a rule, by a saline purge or other cathartic. The employment of an emetic would often answer the same purpose if the patient were seen by the physician at the outset of the eruption. The treatment of chronic urticaria, however, is by no means simple, and often requires the utmost perseverance on the part of both patient and physician. The indications are to relieve the itching and to make a diligent search for the cause of the disease, which should, if possible, be removed. This will be found in many of the cases to be due to some gastro-intestinal disturbance, especially to the ingestion of some particular kind of food. The list of the various articles of food that can give rise to urticaria is too long to be quoted in this brief discussion of the subject. To determine the nature of the offending substance it is often necessary to put the patient upon a diet of milk and to slowly increase the diet until it is seen that the ingestion of some special article of food is followed by the eruption.

It is well known that urticaria may follow the administration of various drugs, a notable example being quinine. The disease may be due to local causes, such as the bites of mosquitoes, fleas, and bedbugs. It may be reflexly caused by the presence of intestinal worms and by diseases of the liver, kidneys, and uterus. It may be associated with gout and rheumatism. Careful examination of the urine may throw light

upon the etiology of the disease. After all our efforts we are often unable to ascertain any cause whatever. We are then compelled to administer empirically one of the numerous remedies that have been suggested, such as quinine (which also causes the disease), salicylate of soda, salol, strychnine, the bromides, ichthyol, calcium sulphide, etc. It is often advisable to put the patient into strict training, or to order a complete rest and change of scene, or a visit to one of the mineral springs.

The local treatment consists in the free use of the antipruritic remedies (described under the subject of *Pruritus*). Powders or lotions are, as a rule, preferable to ointments, except in the cases complicated by vesicles or bullæ. Warm alkaline baths are frequently beneficial. Linen or, preferably, silk underwear should be worn, and the bedclothing should be as light as possible.

Verruca.—There are several remedies whose internal administration is said at times to be able to cure warts. I have always felt that my time would be wasted in giving them a trial. The best treatment in my opinion for a small ordinary verruca is to snip it off with a pair of scissors or to scrape it off with a sharp curette. The base may then be touched with the silver nitrate stick to stop the bleeding. Before the removal of larger lesions it is often advisable to anesthetize the skin by the ethyl chloride spray or the injection of cocaine. Warts can also be satisfactorily removed by the galvanocautery, electrolysis, the high-frequency current, using a sharp-pointed carbon electrode, and by the *x*-rays. The latter method should only be used where the lesions are numerous. The removal of warts by the use of acids is slow, painful, and unreliable, in my opinion.

Vitiligo.—The opinion of dermatologists is practically unanimous that no effect whatever can be produced upon the course of vitiligo by either internal or local treatment. It is, however, only right to state that Savill has reported a cure from the application of carbolic acid and Douglas W. Montgomery the same result by phototherapy. It is possible to temporarily lessen the mottled appearance of the skin by staining the white patches or by removing the pigment from the dark areas by the method described under the treatment of freckles. My own experience in attempting to stain the white patches by walnut juice has been unsatisfactory.

PART IX

NON-SURGICAL TREATMENT OF DISEASES OF THE EYE

OCULAR THERAPEUTICS. NORMAL AND ABNORMAL REFRACTION. PRESBYOPIA AND PRINCIPLES INVOLVED IN FITTING GLASSES

BY JAMES THORINGTON, M.D.

Abscess of the Eyelids (*Phlegmon*).—The treatment of this condition should be general and local. Occurring in children and debilitated individuals, the general health should receive appropriate medication. The alimentary canal, as well as the heart and kidneys, should not be neglected. Locally hot fomentations of boracic acid solution (grains x to 3j) should be applied, or a bichloride solution (1 to 10,000). It may be well in some instances to interrupt the hot fomentations for an hour or so and apply a weak carbolyzed vaseline. Owing to the great amount of cellular tissue in the lids, it has become an old axiom in ophthalmological practice “never to poultice an eye.” When fluctuation is detected, then the surgeon’s knife should be brought into use, followed by the local application of an antiseptic solution, such as the bichloride.

Burns of the Eyelids.—When from acids, as promptly as possible the part should be washed freely with a strong solution of carbonate of soda or potash. Later on the part should be covered with oil or vaseline and protected from the air.

Burns from alkaline substances, such as lime, whitewash, caustic potash, should be treated by applying liquid alboline, vaseline, or sweet oil. When burns of the eyelids from hot water, cigar ashes, burning match-heads, molten metal, or a flame or powder occur, all foreign substances should be carefully removed as soon as possible and sweet oil or a solution of carbonate of soda applied. Powder grains should be thoroughly moistened with peroxide of hydrogen and then removed with the point of a needle or a spud. A 4 per cent. cocaine solution may have to be employed locally to relieve pain when removing the powder grains.

Ecchymosis of the Eyelids.—This condition is usually the result of traumatism, and should be treated like a “black-and-blue” mark, or bruise, in any other part of the body. Cold compresses (gauze or a clean linen handkerchief) wet with ice water should be applied every ten or fifteen minutes for the first few hours if the case comes under observation soon after the injury; but if seen several hours later, then hot compresses of sedative lotions should be employed. I am partial to the following in such cases:

R—Ammon. chloridi ʒj
 Aq. rosæ,
 Aq. destillatæ āā fʒiij
 M. ft. sol.
 Sig.—For local use only.

Or the following will be found of decided benefit:

R—Liq. plumbi subacetatis fʒij
 Tr. opii,
 Tr. belladonnæ fʒj
 Aq. camphoræ,
 Aq. destil āā q. s. ad fʒiv
 M. ft. sol.
 Sig.—Poison. For local use only.

Eczema of the Eyelids.—This is usually erythematous in character, and is often made worse by too free bathing with soap and water; therefore this should be discontinued while more active treatment is being carried out. To relieve the condition the writer has had great satisfaction, where almost every other treatment has failed, with the following ointment, which relieves the vascularity, itching, and burning:

Adrenalin 1 part
 Hydrarg. oxidi. flav. 4 parts
 Ung. boroglyceridi 240 parts
 Lanolin 200 parts
 White petrolatum q. s. 1000 parts
 M. ft. unguent.
 Sig.—Apply locally several times a day.

Of course, any irritants which might be causing eczema should be interdicted.

Epithelioma of the Eyelid.—The application of the *x*-ray is the ideal treatment for this condition, and is curative if the condition is thus treated in its early stages before deep induration has taken place. If the *x*-rays are used after induration occurs there may be a superficial healing, but this soon breaks down a second time. Therefore, when the disease has progressed it is much better to promptly interfere surgically.

Erysipelas of the Eyelids.—This is to be treated as erysipelas would be treated elsewhere in the body. Internal medication is of prime importance, and locally, carbolized vaseline or an ointment of oxide of zinc benzoated. Cloths wrung out of a saturated solution of boracic acid are much enjoyed by the patient as an occasional change of treatment from the ointment.

Hordeolum, or Sty.—This is a common disease, especially among children, usually the result of infection of the hair follicles, and is relieved by removing any loose lashes and applying an ointment composed of the yellow oxide of mercury (grain j to 3j of vaseline); but before applying the ointment it is well to have the lids washed freely but gently with warm water and castile soap, and thoroughly dried. An important part of the treatment is to see whether the patient has dandruff of the scalp, and if so, to have this carefully treated, as only too often patients infect the follicles of the eyelashes with their finger nails after scratching the scalp. If suppuration of the sty occurs, as indicated by a small yellow “head,” this should be freely opened and dressed with an antiseptic wash. The ointment recommended for eczema of the lids, for similar reasons, is very efficacious in the treatment of styes. As eye-strain is a factor in the production of styes, this condition should have consideration in every instance. Necessary glasses should be ordered and carefully selected, under the use of a cycloplegic if the patient is a child or young adult. The use of ichthyol ointment for styes has considerable virtue, but the smell of the ichthyol is often objected to by the patient and many will not use it on this account. I do not recommend giving, as some authorities do, calcium sulphide (grain $\frac{1}{8}$ t. i. d.).

Herpes Zoster Ophthalmicus (*Shingles*).—The treatment of this very painful condition is both constitutional and local. Internally quinine should be given to the point of the physiological effect, and maintained for several hours if malaria is suspected or proved by the examination of the blood. For the immediate relief of the pain it may be necessary to give phenacetin or antipyrin, or even morphine. Locally the parts may be dusted with bismuth powder or oxide of zinc; or, as some prefer, the parts may be painted with flexible collodion alone or containing morphine (grains v to f3j).

Furuncle of the Lid.—This condition is very similar to an abscess, and the treatment is almost the same. If the furuncle should become large or multiple, containing several “cores,” and appears gangrenous, and diphtheritic bacilli be found, then the consideration of serum therapy should be entertained.

Blepharitis (*Blepharitis Ciliaris*; *Blepharitis Pediculosa*; *Blepharitis Tarsi*; *Blepharitis Adenitis Ciliaris*; *Sycosis*).—Whether of the squamous or ulcerative variety, the exciting cause should be removed. The nares and accessory sinuses, also the tear ducts, should be carefully examined, and any necessary treatment applied. The patient's occupation must have consideration, and protecting glasses worn if foreign particles find lodgement on the lid margins, as so often happens among sweepers, workers in sugar refineries, in mills of various sorts, workers in glass factories, tanneries, etc., workers under strong lights, marble- and stonecutters, whitewashers, etc. When the condition is due to pediculi, these should be removed by the careful application of blue ointment, or the lids pencilled with a strong solution of bichloride of mercury or with gasoline (in the open air). The original source of the pediculi should be vigorously treated also. All scales and loose cilia

should be removed after being thoroughly softened with oil or vaseline. After a thorough cleansing of the lid margins and careful drying, the parts should be freely smeared several times a day with the ointment recommended for eczema. The patient's general condition may require fresh air and tonics.

Zanthelasma (*Zanthoma*, or *Vitiligoidea*).—This yellowish-colored patch of newgrowth in the connective tissue of the lids of female patients about forty or forty-five years of age is amenable to treatment, if not too large, either by careful dissection or by the local and careful application of trichloroacetic acid, one, two, or possibly three applications being necessary, with two or three days' interval between applications. The patient should always be previously informed that a white scar usually persists. Personally, I prefer to dissect out the growth and stitch the wound, which only leaves a wrinkle in the skin, and is no disfigurement.

Urticaria (*Hives*).—This unusual condition appearing in the lids is subject to the same consideration as when it appears elsewhere. The exciting intestinal cause must be removed, and locally a good application is a solution of the hyposulphite of soda in the strength of one dram to the ounce of distilled water. It is to be applied to the closed lids with gauze wrung out of this solution. Cloths wet with hot normal salt solution are equally efficacious in many instances.

Rhus Poisoning of the Eyelids.—I have obtained great satisfaction and my patients much comfort in treating cases of ivy poisoning by applying cloths slightly moistened with the following lotion, which must be thoroughly shaken before applying to the cloth:

R—Ex. grindelia robustæ fl.	f℥j
Glycerin. puræ	f℥j
Aq. destil.	q. s. ad f℥vj
M. ft. sol.	

Sig.—Poison. Apply locally as directed, and shake bottle before making application to the cloth.

Chalazion (*Tarsal Tumor; Tarsal Cyst; Meibomian Cyst*).—When the duct of the Meibomian gland becomes obstructed its secretion is retained, and hence the round swelling seen and felt beneath the skin of the lid, resembling a shot or hailstone. If seen early and when quite small or soft, frequent and gentle rubbing with the tip of the finger will occasionally reduce the swelling and open the duct. Or the ointment of the yellow oxide of mercury (grain j to ℥j) may be rubbed into the skin over the swelling two or three times a day. If this treatment is of no avail, then the growth must be incised at the proximal surface, and the sac carefully curetted and broken up. Any error of refraction must have careful attention, as chalazia, like stytes, frequently result from eye-strain.

Alopecia Areata.—This condition frequently accompanies alopecia of the scalp, and is recognized as neurotic in character. The internal administration of arsenic and tonics are recommended. Vaseline alone or combined with calomel (grain x to ℥j) may be applied to the lid margins at bedtime.

Burns of the Conjunctiva.—The same treatment obtains as that recommended for burns of the lids, with the additional precaution that adhesions between the eyeball and the lid should be prevented if possible. This is accomplished during the healing process by gently pulling the lid away from the ball several times a day, and at the same time dropping between the lids a drop or two of liquid albolene.

Foreign Bodies beneath the Lids (*Cinders; Sand; Particles of Brick; Stone; Lime; Emery; Ashes; Glass; Face Powder; Powder Grains; Sawdust, etc.*).—These particles usually lodge on the under surface of the upper lid, occasionally on the under surface of the lower lid, or far back in the fornix (where the conjunctiva of the lid continues on to the eyeball) or on the cornea. In any instance the conjunctiva should be freely irrigated or washed, using a medicine dropper and a warm normal salt solution or a solution of boracic acid. If there is much pain or discomfort a drop of a 2 or 4 per cent. solution of cocaine should be instilled as necessary. If flushing the eye does not dislodge the foreign substance, then the end of a match stick carefully wrapped with a small quantity of sterile absorbent cotton, and wet with a 2 per cent. solution of cocaine, may be drawn over the foreign matter, and in this way it is usually dislodged. To evert the lower lid the physician holds it with the tip of his index finger and makes gentle traction downward as the patient looks upward. To evert the upper lid the patient is told to look downward, and as he does so the surgeon takes hold of the eyelashes of the upper lid with the thumb and index finger of his right hand, and using the end of his left thumb as a fulcrum, he presses on the upper lid and at the same time turns the lid up on to the end of his thumb. The very important part of this manipulation is for the patient to keep looking downward. Occasionally foreign substances lodge in the fornix, and may be felt by the patient and not seen. Then the surgeon must use his match stick, prepared as before, and pass it well up into the fornix and from side to side. In this way foreign substances seldom escape if present.

Particles of glass are very difficult to see and very difficult to remove, as they cut their way into the tissues; however, careful perseverance usually succeeds. Staining the tissues with fluorescein may assist in locating foreign substances.

R—Fluorescein	gr. iv
Liq. potassa	5j
Aq. destil.	f5iv—M.

Sig.—Instil one drop, and then irrigate the eye with distilled water.

The areas where the foreign bodies have lodged will then appear yellowish green.

Another excellent way to locate pieces of glass is to apply, or rub, on the surface of the conjunctiva a small blunt steel instrument, such as a spud, and as the glass is touched the patient feels the contact and the glass sticking into the part, and in this way he can advise the surgeon of the exact spot. The after treatment is to apply cold compresses and protect the eye for a day or two.

If perchance the cornea has been injured from any foreign substance,

it is the part of good treatment to instil a cycloplegic and avoid any danger of iritis which might otherwise follow.

Argyria Conjunctivæ (*Argyrosis*).—Staining of the elastic fibers is due to prolonged use of a solution of a silver salt, nitrate, protargol, argyrol, and largin, especially protargol, and for this reason the physician should never prescribe these drugs, but had better keep them for office use only. There is no remedy for the condition.

Subconjunctival Hemorrhage.—This condition, whether due to trauma, sclerosis of the vessels, sneezing, vomiting, or coughing, as often comes with whooping cough, is to be relieved by frequent washings with normal salt or boracic acid solutions. When the cause cannot otherwise be determined, the patient's arteries should be carefully examined, as also his blood pressure taken, and the heart and kidneys must be looked after, as only too frequently a subconjunctival hemorrhage in an adult means more than local trouble, the local condition being an indication of a gross malady elsewhere.

Conjunctivitis Simplex.—Removing the exciting cause is the first part of the treatment of this rather common condition (bright lights, dust particles, tobacco smoke, etc.). Glasses must be ordered if necessary, as this variety of conjunctivitis is often due to eyestrain. Hot compresses are enjoyed by many young subjects.

Dark glasses (plane London smoked "D") may be worn, for protection only, and not constantly. The eyes should never be bandaged.

If at any time the discharge becomes purulent, the everted lids should be gently touched with a solution of silver nitrate (grains ij to ʒj) and immediately neutralized with salt solution. The silver application is made with a small quantity of absorbent cotton wrapped around the end of a match stick, and the cotton made moist with the solution. Neutralization of the silver is done by flushing with normal salt solution, using a medicine dropper.

One of the following solutions may be prescribed for the patient to use every hour or two with a medicine dropper or an eye cup.

R—Acid. boracic. gr. xxx
Aq. destil. fʒiiss

M. ft. sol.

Sig.—Use freely as an eye wash.

R—Cocain. hydrochlor. gr. j
Acid. boracic. gr. xxx
Aq. destil. fʒiiss

M. ft. sol.

Sig.—Use freely as an eye wash.

R—Cocain. hydrochlor. gr. j
Acid. boracic. ʒss
Aq. camphor. fʒiiss
Aq. destil. fʒij

M. ft. sol.

Sig.—Use as directed.

Chronic Conjunctivitis.—This may be an independent condition, as frequently observed in the aged, or it may be the result of an acute

attack. However, the treatment calls for cleanliness on the part of the patient, with the use of one of the washes prescribed for the acute or simple conjunctivitis, and the physician himself should make applications from time to time with glycerol of tannin (grains x to f $\frac{3}{j}$), or touch the conjunctiva, carefully, with a crystal of alum. Refractive errors should be corrected, and any obstruction of the tear passages must have careful attention.

Lacrymal Conjunctivitis.—This is the chronic conjunctivitis just referred to, and receives its name from some obstruction in the tear duct.

Atropine and eserine conjunctivitis are names given to a conjunctival condition the result of any prolonged use of one of these drugs, and so the name accords with the drug which caused the irritation. The treatment is to remove the cause and apply a simple lotion.

Acute Contagious Conjunctivitis (*"Pink Eye;" Epidemic Catarrhal Conjunctivitis; Koch-Weeks Bacillus Conjunctivitis; Acute Mucopurulent Conjunctivitis; Epidemic Conjunctivitis*).—This condition, as its name implies, is often epidemic and contagious, therefore the two eyes are usually affected, one a little in advance of its fellow. The swollen conjunctiva, small scattered hemorrhages, thick and ropy or stringy secretion which glues the lids and cilia, together with a feeling of heat and sand in the eyes, all call for prompt and constant attention. Cleanliness of the parts by frequent washings with cold normal salt solution or a cold boracic acid solution are most agreeable to the patient, and reduce the burning, swelling, and irritation. Dark glasses may be worn for protection, but under no circumstances should the eyes be bandaged. The patient must be isolated to a certain extent, no one else being allowed to use the patient's towels or washbasin, or to occupy the same bed. This part of the treatment must be insisted upon in institutions. The physician, after cleansing the conjunctiva very thoroughly and gently with a solution of boracic acid, should apply with a cotton carrier (match stick as elsewhere described, see foreign bodies) a solution of silver nitrate (grains ij to v to $\frac{3}{j}$) to the everted lids, and immediately neutralize it with normal salt solution. The silver solution acts as an astringent and germicide. This office treatment with the silver solution must be continued daily so long as there is any purulent secretion. Just before retiring for the night the patient should apply a small quantity of vaseline to the lid margins to keep them from sticking together during sleep. Atropine solution is not a part of the treatment of "pink eye" unless the cornea becomes involved. It is a wise precaution in every instance in which there is a mucopurulent or "pussey" discharge from the conjunctiva to have this secretion microscopically examined. The presence of the Koch-Weeks bacillus is considered by some writers quite a distinctive disease, hence the name. Personally, I am not partial to the use of solutions of protargol (5 to 15 to 20 per cent.), or argyrol (5 to 20 per cent.), or argentamin (2 to 5 per cent.), and largin (10 per cent.) in place of the nitrate of silver solution above described, feeling satisfied that if results cannot be obtained with silver nitrate they will not be gotten—or at least not as promptly—with the newer salts of silver.

General Consideration of the Treatment of Conjunctivitis.—The diagnosis and treatment of conjunctivitis should not be difficult, and the day has passed when the trained physician would cloak his ignorance and suggest careless treatment by diagnosing any “red eye” as “a cold in the eye.” The physician of today knows that most cases of conjunctivitis are of bacterial origin. Conjunctivitis in its numerous varieties gives many symptoms, one or more of which appears conspicuous in a special kind.

Severe pain is never a marked symptom of conjunctivitis unless there is a foreign body present or the cornea or iris are involved, and this important fact leads to a correct diagnosis.

Hyperemia is usually present, and may be so severe that large hemorrhages or small ones are in evidence.

The discharge may be watery, or mucopurulent, or possibly purulent. Swelling of the palpebral conjunctiva, or the ocular conjunctiva, or of the lids, or of all these parts, may be seen at a single glance. Photophobia (dread of light) of a mild character is usually present, and only becomes unbearable when other structures (cornea or iris) are involved or a foreign body is present.

Some dimness of vision is complained of at times if the secretions cover the cornea. Burning, itching, and feeling of sand in the eyes are the chief symptoms of which the patient complains in the usual case of conjunctivitis.

The two chief parts of the treatment are cleanliness and the destruction of the bacteria. It is, therefore, a valuable part of the treatment to have the discharge or membrane in each case microscopically examined, looking for the Koch-Weeks bacillus of acute contagious ophthalmia, the Klebs-Loeffler bacillus of diphtheria, the pneumococcus, the Morax and Axenfeld diplobacillus, which causes the angular conjunctivitis, and the gonococcus of Neisser, this latter especially causing blindness unless treated promptly and vigorously. (See Ophthalmia Neonatorum and Gonorrheal Ophthalmia.)

The major part of the treatment of any case of conjunctivitis is the free use of a wash to keep the tissues clean. There is nothing better than boracic acid solution (grains v to x to xv to ʒj). There is nothing specific in its action; its great virtue is that it is a safe remedy, and the parts are kept clean.

Any antiseptic solution of sufficient strength to stop the growth of the pathologic bacteria would injure or destroy the cornea and conjunctiva. Bichloride of mercury, 1 to 10,000, may sound like very vigorous treatment, but such a weak solution is merely cleansing in its action, and any solution of bichloride stronger than this is dangerous to the vitality of the tissues. The great thing about cleansing is to cleanse thoroughly, not neglecting the folds of the conjunctiva and the fornix of each lid.

Silver nitrate is the most valuable astringent we possess in the treatment of conjunctivitis, but it should not be prescribed for the patient to use at home, as it is liable to produce argyrosis unless properly neu-

tralized. The same may be said about the newer salts of silver. While cocaine and adrenalin solutions are excellent anesthetics, and reduce hyperemia and are very agreeable to the patient, yet there is danger attached to the use of these, as they are liable to disintegrate the corneal epithelium, producing ulceration, and this is especially apt to occur if the patient is old or debilitated, and with the result that poor vision may follow.

Zinc sulphate (grains ij to \mathfrak{J} j) or zinc chloride (grain j to \mathfrak{J} j) is quite painful to some eyes, but these solutions have a selective action on the Morax and Axenfeld bacillus.

Ophthalmia Neonatorum (*Conjunctivitis Neonatorum*).—This serious and highly infectious disease of a baby's eyes usually appears one or two or three days after birth, the infection having taken place during the passage of the head through the maternal parts, the mother suffering from leucorrhea or gonorrhea. This is the only plausible explanation of the infection, unless some careless attendant has carried the poison by means of a towel, sponge, or soiled hands. The microscopic examination of the discharge from the conjunctiva soon furnishes the diagnosis. The age of the young patient, the great swelling of the lids, and the free watery or mucopurulent discharge are indicative that we are dealing with a disease which usually runs a quick course, and by its destructive action on the cornea is the cause of 30 per cent. of the blind in the United States alone. The treatment must be prompt and thorough. A clean towel is spread over the physician's lap, the child's head, face upward, is placed between the physician's knees; the nurse, sitting in front of the physician, holds the rest of the child's body. In this position the upper lid is raised by a small lid elevator and the parts beneath thoroughly irrigated with a solution of boracic acid every hour until the discharge diminishes or ceases entirely. Once each day, after thorough irrigation, the physician applies a solution of silver nitrate (grains v to \mathfrak{J} j) and neutralizes it at once with normal salt solution. As soon as all purulent discharge ceases, then the silver treatment may be discontinued. Between the hourly irrigations with the boric wash the lid edges should be gently touched with vaseline to keep them from sticking together and allowing the secretion from the conjunctiva to escape. Over the closed lids may be placed pledgets of cotton wet with the boric solution. Whenever any discharge appears it should be wiped away, and if necessary the irrigation must be repeated oftener than every hour. Ophthalmia neonatorum is usually bilateral, one eye becoming infected a day or so before its fellow. If one eye alone is infected, it demands great care on the part of all the attendants to keep the other eye free from the disease, and it in turn should have separate towels and basin.

Prevention of Ophthalmia Neonatorum.—When the prospective mother has a vaginal discharge, then a regular daily cleansing of the vagina with an antiseptic wash, for several days before parturition, should always be insisted upon, and if its necessity is explained the mother will gladly carry out the instructions. Soon after the birth of the infant, the

eyelids having been cleansed, the lids are carefully held apart and one drop of a 2 per cent. solution of silver nitrate is carefully dropped into the eye or on to the conjunctiva. This is known as the Credé method. Protargol and argyrol have their advocates in the treatment of this disease, claiming, and justly so, that these drugs are not nearly so irritating as silver nitrate, but I claim again that the older silver salt is by far the most reliable.

Exanthematous Conjunctivitis.—This is a conjunctivitis accompanying one of the eruptive fevers, measles, scarlet fever, or smallpox, and may appear before the skin manifestation. The treatment calls for cleanliness, with normal salt solution or boracic acid solution, and the patient in a darkened room. If ulcer of the cornea becomes a complication, as is evident by pain, photophobia, and lacrymation, then an ointment should be ordered as follows:

R—Atropin. sulph.	gr. $\frac{1}{4}$
Hydrarg. oxid. flav.	gr. ij
Ung. petrolati	℥ij
M. ft. ung.	

Sig.—A small quantity, the size of a small pea, to be placed inside of the lids, followed by gentle massage, so that the ointment becomes well spread over the cornea. This may be repeated two or three times a day if necessary.

Gonorrheal Ophthalmia.—This is similar to ophthalmia of the newborn but usually one eye alone is affected, generally the right if the patient is right-handed, as the discharge from a gonorrhea or gleet is carried into the eye. The conjunctival discharge generally reveals the gonococcus of Neisser. The conditions and treatment are similar to those in ophthalmia neonatorum, *i. e.*, cleanliness, cold compresses, vaseline, and silver nitrate solution (grains x to xx to xxx to ℥j), and atropine if indicated. The unaffected eye should be promptly protected by a Buller's shield. This is made by sewing a watchglass between two layers of rubber cloth (each layer having a round hole cut through the centre over the glass). Adhesive strips at the edges of the rubber cloth hold the glass securely about the eye. Or a better way, in my opinion, is to cover the good eye with three or four layers of sterile gauze, and over these to place some absorbent cotton and other layers of gauze, and then cover all with flexible collodion down to the edges and on to the surrounding skin.

All dressings used about the eyes, and especially those eyes with gonorrheal infection and diphtheria, should be destroyed by burning.

Diphtheritic Conjunctivitis.—This rare conjunctival disease may appear as a local manifestation or be associated with pharyngeal diphtheria. The gray exudate in the conjunctiva is quite diagnostic, but the microscope reveals the Klebs-Loeffler bacilli, and makes the diagnosis sure. Other microorganisms are also found, the streptococci and staphylococci. When the disease is recognized the patient should be isolated and full doses of antitoxin (1500 to 2000 units) administered, and repeated as occasion requires. Cleanliness is important, and permanganate of potash (1 to 1000) may be applied on pledgets of cotton,

and also used as a wash. If one eye alone is affected, the other eye should be protected as suggested in gonorrheal ophthalmia. The patient's health should be supported when necessary with strychnine, etc.

Croupous or Pseudomembranous Conjunctivitis (*Plastic or Membranous Conjunctivitis*).—This condition resembles the diphtheritic variety, but in this instance the membrane is upon the conjunctiva and not in it. Microscopic examinations of the secretions have revealed diplococci, staphylococci, and non-virulent Loeffler bacilli, as also pneumococci. The treatment calls for ice compresses, irrigation, silver nitrate solution, and in doubtful cases the administration of antitoxin.

Follicular Conjunctivitis.—This disease of children is manifested by slight photophobia and a stinging and burning sensation. When the lids are everted the follicles are seen extending in rows parallel to the lid margins; the individual follicle is the size of a pinhead, or sago grain, and all together they look not unlike fish roe. The disease is communicated by infected towels, washbasins, etc., so that the patient should be partially isolated, *i. e.*, taken out of school or an institution. Cleansing with boracic acid solution is important, and the follicles should be touched occasionally with a weak silver nitrate solution, or touched with an alum crystal and the excess washed off with distilled water. An ointment containing copper sulphate (grain $\frac{1}{4}$ to $\frac{3}{8}$ of vaseline), a small quantity to be rubbed into the folds of the conjunctiva once a day, is useful. While I do not recommend protargol for this disease, yet it has its advocates. Fresh air is an important part of the treatment, and dark glasses for protection from bright light and particles of dust. Refractive errors must be corrected. Tannin and glycerin (grains x to $\frac{3}{8}$) applied occasionally does much good in some cases, as does also 50 per cent. boroglyceride. The latter two are very painful for a few minutes.

Trachoma (*Granular Ophthalmia; Granular Lids; Granular Conjunctivitis; Military and Egyptian Ophthalmia*).—Granular elevation of the conjunctiva usually on the upper lids of both eyes furnishes a diagnosis of this disease that is seldom mistaken except possibly for the follicular variety or Parinaud's conjunctivitis. It is a highly contagious malady, and is often transmitted by infected towels, washbasins, etc. The bacillus has not been definitely isolated. Trachoma usually comes under observation as a chronic condition, having a mucopurulent secretion. The treatment calls for isolation, extreme cleanliness, and, as it is a chronic disease, taking years for a permanent cure to be obtained, caustics, astringents, and operations for the destruction or removal of the granulations must be used and instituted. Constitutional treatment and attention to hygiene are important also. Boracic acid wash should be used freely several times a day, and this may be varied with one of several antiseptic washes. Bichloride of mercury (1 to 10,000) or permanganate of potash (1 to 3000). Locally, by virtue of glycerin's affinity for water and the astringent effect of tannin, the glycerol of tannin becomes a valuable remedy in this disease, although it is not curative

(tannin acid, grains x, to glycerin, 3j). This is applied with a cotton swab to the everted lid. There is great smarting from this application, and the tears and secretion flow freely. One application daily for several weeks is good practice, and then the treatment may be changed to a 50 per cent. boroglyceride and used in the same manner. Then, again, this treatment may be varied by touching the trachoma granules with a crystal of copper sulphate and washing off the excess copper with sterile water. Weak silver nitrate solutions and protargol and argyrol are advocated. The use of weak solutions of cyanide of mercury injections, as practised by Smith in India, where the disease is quite common, is highly extolled, although there is no literature on the subject at the present writing. The x-ray treatment has a few advocates, as also the high-frequency current. I have never had any personal experience with either of these.

The various operations for the removal of the trachoma granulations either by expression or excision or curetting (grattage), or with sand-paper, etc., are not parts of the treatment considered in this chapter.

Pannus.—One of the unfortunate sequels of granular lids is the development of pannus, which is in reality a vascular keratitis occupying usually the upper portion of the cornea. It is somewhat of a disputed point whether pannus results from the friction of the granulations on the cornea during the act of winking or whether the trachoma is carried into the corneal epithelium by contiguity of structures. The treatment for trachoma applies to the treatment of pannus. The pannus generally grows less severe as the granulations in the conjunctiva are brought under subjection. Cases of trachoma, in days gone by, were occasionally treated by inoculating the conjunctiva with gonorrheal pus. Such treatment today would be considered criminal. However, there is one drug that sets up a severe inflammatory reaction, and that is the old remedy, jequirity, the reaction being an artificial purulent ophthalmia. The preparation used is the jequiritol extract in a sterile solution, with 50 per cent. glycerin. One drop is carefully placed on the everted lid and the eye closed. Conditions are watched to find out what amount of inflammation follows, and if necessary this treatment is renewed daily and the amount of the drug gradually increased until an acute inflammation results. After this inflammation passes away the same use of the drug is repeated from time to time until finally there is immunity. Jequirity is not to be used in cases of recent pannus, nor if ulceration of the cornea is present. Sweet and Cheatham are advocates of the jequirity treatment.

As granular conjunctivitis is most common among the Russian Jews, Poles, and Italians, and those of the poorer or lower classes of uncleanly habits and surroundings, they should, if possible, in addition to local remedies, receive plenty of fresh air night and day, good food, and a generous tonic treatment. Dark glasses are always necessary when out-of-doors.

Parinaud's Conjunctivitis (*Infectious Conjunctivitis; Septic Conjunctivitis*).—This unusual condition, usually of one eye, resembles trachoma

somewhat, but the granulations are larger and more scattered. There is an associated enlargement of the neighboring lymphatics and some constitutional disturbance. Cleanliness, with antiseptic collyria and applications of solutions of the silver salts or the copper crystal are advocated. Antitoxin injections have been tried and advocated.

Phlyctenular Conjunctivitis (*Phlyctenular Ophthalmia; Scrofulous Ophthalmia; Eczema of the Conjunctiva*).—A disease of childhood, as a rule, and affecting one or both eyes. It occurs usually in children who are poorly nourished or improperly fed and poorly housed. The eye condition is usually associated with an eczematous eruption about the lids, the corners of the mouth, the nares, and ears. One or more phlyctenulæ (small blisters) appear on the conjunctiva close to, or just at, the edge of the cornea (limbus). These blisters have several conspicuous vessels running to them. There is intense dread of light and excessive lachrymation. If the blisters break down an ulcer forms. Vision is never damaged unless the phlyctenule forms upon the cornea over the pupillary area. (See Phlyctenular Keratitis.) The treatment is local and constitutional. Cleanliness, with warm boracic acid solution every hour or so, and the use of an ointment containing atropine and the yellow oxide of mercury (see Exanthematous Conjunctivitis), to be applied once or twice a day. The ointment, without the atropine, may be applied to the edge of the lids and also to any other patches of eczema about the mouth, ears, or nose. Dark glasses must be used to shield the eyes, and the patient must be taken out-of-doors whenever the weather permits.

The diet must be strictly regulated, stopping tea and coffee and all pastry and sweets. Meat should be eaten sparingly. Milk may be taken freely. Calomel and santolin should be prescribed at once, followed by a purge, as many cases of phlyctenular disease are undoubtedly due to worms. Any necessary tonic, such as syrup of iron iodide, or cod-liver oil, and the like, may be ordered. The nasopharynx must have attention also.

A general bath each day is advantageous, followed by a good gentle rubbing of the entire body. Any recurrence of the phlyctenulæ means a falling off of the regular life, and treatment must be renewed. Adults are occasionally affected, and the same treatment applies to them as to children. The strength of the boracic wash for the adult, as also the other medications, may have to be increased. Occasionally when a phlyctenule breaks down and forms an ulcer it will have to be touched gently with a solution of silver nitrate (grain iv to ʒj).

Vernal Conjunctivitis (*Spring Catarrh*).—The chief characteristic of this disease is the intense itching which usually affects both eyes of children and occasionally of adults. It is a disease that recurs each spring and summer for a number of years. The discharge is watery or very slightly mucoid; seldom does it glue the lids together. The patient naturally rubs the eyes to relieve the itching, and as a consequence the eyes immediately redden to an alarming extent, the hyperemia not being extensive or deep if the eyes are not rubbed. Vernal

conjunctivitis has a certain resemblance to hay fever in that it disappears when cool weather returns in the fall of the year. If a cool spell comes during the summer, the eyes show improvement and the itching diminishes in severity. There is no panacea for vernal conjunctivitis; the nearest approach to it is to send the patient to a cool climate during the summer months. Two patients of mine got immediate and permanent relief at the seashore, but the disease just as promptly returns when these patients venture into the city before the first frost. A cool climate has no effect on some of these unfortunates, a high altitude and a sea voyage not making any material difference in the symptoms; but the simple fact that it was the spring or summer months meant that the disease must run its course. However, if the patient can afford it, a cool atmosphere should be tried in every instance. Careful attention to the patient's general health must be given, and the nares must be inspected and treated for any hypertrophies or swellings of the turbinated bodies. Fowler's solution in small doses is highly recommended. Locally the various mild collyria may be tried. Washes containing adrenalin or cocaine should not be employed, on account of their deleterious action on the cornea. At first thought, these drugs would seem to be particularly indicated, but it is dangerous practice to use them. Cold compresses are much appreciated by some, but other patients prefer a wash or irrigation of warm normal salt solution, the latter often putting a stop to the intense itching for some time. The various silver salts in weak solutions may be used. One drop of a solution of zinc sulphate (grain j to $\text{ʒ}j$) may be used daily. Dark glasses, fresh air away from the bright sunlight, and a selected diet suitable for warm weather, with not too much meat, must be insisted upon.

Foreign Bodies on the Cornea.—A foreign substance lodging upon the eye beneath the lids is quite painful while in contact with the conjunctiva and yet endurable, but the instant this substance lodges upon the cornea or becomes embedded in the cornea, or is rubbed upon the cornea by the lids in the act of winking, then the pain is very acute and most excruciating. Any foreign body lying upon or embedded in the cornea should be removed after having irrigated the parts and instilled one or two drops of a solution of holocain hydrochlorate (grain j to $\text{ʒ}ij$). Holocain has displaced the use of cocaine with many ophthalmologists when used upon the eye, as it possesses antiseptic qualities, is very prompt in its action, does not dilate the pupil, and does not destroy the corneal epithelium. After preparing the eye in the manner suggested the physician wraps absorbent cotton about the end of a match stick, and wetting this with the holocain solution wipes off the foreign substance. If it is not removable in this way, then it will be necessary to employ a spud made specially for the purpose. Powder grains and other substances are to be removed from the cornea in the same manner as directed for removing them from the conjunctiva. If the cornea has been damaged by the foreign substance or by manipulation, it is well to prescribe an eye wash of boracic acid and also to bandage the eye to keep it quiet and to keep the edges of the lids from scraping the corneal wound or

abrasion each time the lids come together. Of course, the bandage must be removed every hour or so that the eye may be irrigated.

Burns of the Cornea.—These are to be treated as are burns of the conjunctiva, but in addition it is always well to instil a drop of atropine solution (grain j to $\overline{3}j$), as this will keep the eye perfectly quiet and minimize the danger of a subsequent iritis.

Injuries of the Cornea.—Aside from foreign substances lodging on the cornea and also burns of the cornea, the cornea may be scratched by pins, needles, twigs, lead pencils, scissors, finger nails, etc. One of the most painful injuries of the cornea that can possibly be produced is by the fine finger nails of an infant, as occasionally happens while the mother is nursing her baby, the infant innocently putting its finger into the mother's eye. It acts like a razor blade and cuts the tiny nerve beneath Bowman's membrane. The same thing happens when a wisp of straw from a whisk strikes the cornea. The ideal treatment for these minute incised wounds is to cauterize them with a weak solution of silver nitrate and neutralize it at once and bandage the eye as necessary, changing the bandage only when it is necessary to bathe it.

Phlyctenular Keratitis.—This is frequently associated with phlyctenular conjunctivitis, and its cause is usually the same. The treatment is general and local, with the addition that atropine must be instilled or applied in the form of an ointment, to relieve, or prevent, any iritis or cyclitis that might be present or threatening. If an ulcer of the cornea develops from the phlyctenule, it must have the attention prescribed under corneal ulcers. As the various external inflammations of the eye are often associated with disease of the nares or nasopharynx, it is always well to inspect these parts and prescribe accordingly.

Ulcer of the Cornea.—The variety of corneal ulcers is innumerable; they are usually named from their location—central, peripheral, or marginal; by their appearance—clean, gray, foul, deep, ring, excavated, sluggish, spreading, serpiginous or purulent; from their cause—traumatic, phlyctenular, exanthematous, tuberculous, specific, etc.

Most ulcers cause intense photophobia, lacrymation, and pain. While most ulcers require much the same treatment in common, yet there are certain remedies for individual cases. Every corneal ulcer should be kept clean with one of the many collyria, boracic acid solution, normal salt solution, solution of bichloride of mercury (1 to 10,000), permanganate of potash solution (1 to 5000), etc. The eye should be protected with dark glasses, or, if there is no purulent secretion about the ulcer or in the conjunctiva, the eye may be bandaged to keep the lids quiet and at the same time to keep out the light. And when there is no indication of glaucoma, atropine should be instilled to keep the iris and ciliary body at rest. The foregoing treatment alone will cure most cases of corneal ulcer. However, there are certain ulcers (foul, creeping, spreading, indolent, etc.) which will require additional treatment, such as cauterizing or stimulating. An ulcer, if it shows a tendency to heal, will soon become clear or clean, but if it remain gray or shows any tendency to spread, it should be anesthetized with a 1 per cent. holocain

solution and then touched very carefully with a solution of silver nitrate (grains v to \mathfrak{Z} j). This application is made by whittling the end of a match stick to a point as small as a pinhead and dipping this in the silver solution. The stick will be sufficiently moistened to touch the ulcer without having the solution spread upon the healthy cornea.

If the ulcer does not clear in a day or two it may be necessary to curette it or make another application of the silver solution of the strength of 10 grains to the ounce. Other authorities recommend touching with trichloroacetic acid, tincture of iodine, or nitric acid, or absolute alcohol or formaldehyde (1 to 50), or heating the end of a strabismus hook red hot, and touching the ulcer. A very good way to stimulate an ulcer is to apply a small quantity of the yellow oxide of mercury ointment (grains ij to \mathfrak{Z} j of vaseline), or to dust a small quantity of calomel into the eye. This latter should not be done if the patient is taking iodide of potash, as a chemical reaction might take place and create great discomfort.

The general health of the patient must never be neglected, as many cases of corneal ulcer appear in debilitated subjects, as patients suffering from malaria, syphilis, rheumatism, etc.

Ulcers are often reflex, occurring in subjects with decayed teeth; obstruction of the tear duct, etc.

Perforation of the Cornea.—If the corneal ulceration extends deeply, it is liable to perforate the cornea; this should be prevented if possible, therefore the ulcer must be handled gently when the ulceration approximates Descemet's membrane. The eye should be put at rest as much as possible, the patient be kept on his back, and, if there is no contraindication, a light bandage applied to support the cornea, the bandage to be removed when it is necessary to dress the ulcer and then to be reapplied. Paracentesis of the cornea will often stop an impending perforation, and it may have to be repeated. If the ulcer is central it is wise to keep the pupil dilated in case perforation takes place, and in this way keep the iris from getting into the wound as the aqueous gushes through. If the ulceration is peripheral, then use eserine and contract the pupil so that the periphery of the iris will alone engage in the perforation. If the iris should prolapse it may have to be cut off under strictly antiseptic conditions. If seen as soon as the prolapse takes place, attempts should be made to replace it with the end of a blunt probe. The corneal wound may be closed with a strip of conjunctiva dissected from the ocular conjunctiva, and with a pedicle for its own support is to be crowded into the perforation and the eye bandaged for two or three days. If iris tissue remains in the wound while healing takes place, then there will be formed an anterior synechia and deformity of the pupil.

Abscess of the Cornea.—When pus forms or collects in the layers of the cornea, hypopyon is usually associated with it. The pus must be evacuated, and usually the best way to accomplish this is by an incision through the overlying corneal layers. The cavity should be cleansed either with peroxide of hydrogen or argyrol solution (10 or 20 per cent.) and the eye bandaged and treated as for simple ulcer. Some authorities

recommend dusting the corneal wound with iodoform after cleaning out the abscess.

Occasionally sluggish ulcers are stimulated to heal by instilling a solution of dionin 5 per cent.). One drop of this solution in the eye each day for three successive days. It acts as a lymphagogue. If the physician has never used this drug he must not become alarmed at the excessive swelling of the ocular conjunctiva which immediately follows its use. In place of using the solution, a small amount of the powder may be dropped directly on to the conjunctiva. The eye soon becomes tolerant to the drug, so that when the third instillation is used there is comparatively little swelling. Therefore it is well to wait a few days before using it again. I have had no experience in treating corneal ulcers with serum, although some few authorities recommend such treatment (pneumococcus or antipneumococcus serum). Subconjunctival injections of normal salt solution or cyanide of mercury solution (1 to 5000), using about five or ten drops, or mercury bichloride (1 to 5000), have been used in the treatment of corneal ulcers, but if possible the latter two should be reserved for specific cases, as dionin gives all the necessary lymphagogic effect necessary and is much more easily applied.

Sequels of Corneal Ulcers.—The cicatrix which remains after the healing of a corneal ulcer is known as an opacity. If very superficial or thin it is known as a nebula (cloud); if small and dense, a macula (spot); if large and white, a leukoma (milk white). When the opacity is situated at the pole of the cornea the vision is very much impaired, when situated near the pole the vision is not so seriously damaged, although very deficient. The nearer to the periphery the opacity is situated the better the vision. A difference in the length of the radii of curvature of the cornea (astigmatism) naturally results from a corneal opacity, and correcting glasses are necessary, as a rule, although it is seldom possible, and, in fact, it is usually impossible to obtain normal vision with any glass or lens if the opacity encroaches on the pupillary space. Eyes having large leukomas seldom have the vision improved by any treatment other than by an iridectomy beneath a portion of clear cornea. If, however, the opacity is recent, small, and in a child or young subject, there is some hope of diminishing the density by massage through the closed lids for ten or fifteen minutes once a day for some weeks, first applying a small quantity of the ointment of the yellow oxide of mercury (grain j to $\mathfrak{z}j$). The eye naturally becomes reddened under this treatment, and that is the idea to stimulate absorption of any inflammatory products. Dionin acts favorably in some instances and is highly recommended. Subconjunctival injections of normal salt solution may benefit also. Good results have been reported from the use of galvanism. Personally I am not sanguine as to any treatment for the removal of corneal opacities if the corneal structure has once been destroyed. Another of the sequelæ of corneal ulcer and perforation is a partial or complete bulging (staphyloma) of the cornea. This results because the cornea is now too weak to support the intra-ocular pressure. There is no medical treatment of any value for this condition,

and it may require surgical intervention in the way of evisceration, extirpation, or enucleation.

Herpes of the Cornea.—This condition often accompanies herpes of the lids, elsewhere described in this chapter. Small vesicles form upon the cornea, break down, and form an irregular ulcer. This variety of ulcer is to be treated locally with an appropriate wash of boracic acid, atropine instilled, and a bandage applied. Quinine is usually indicated internally, as these patients are often affected with malaria. Careful attention must be paid to the alimentary canal. In tuberculous patients a generous building-up plan of treatment and out-of-door life must be prescribed.

Dendriform or Branching Ulcer.—This ulceration of the cornea resembles the figure seen in a moss agate, hence its name. It is usually associated with a low vitality. Photophobia, lacrymation, pain, and dim vision are the chief symptoms. Atropine solution and dark glasses or a bandage are to be ordered in the way of local treatment, as also a boric wash. Tonics, quinine, arsenic, fresh air, a generous diet, and attention to the bowels must be prescribed.

Interstitial Keratitis (*Syphilitic Keratitis; Diffuse Keratitis; Strumous Keratitis; Parenchymatous Keratitis*).—While this condition of the cornea may develop rather acutely, yet it is recognized as a chronic malady, extending over weeks and months, involving one or both eyes, one eye sometimes getting almost well when the fellow eye becomes involved. Intense photophobia, lacrymation, pain, and dim vision dependent upon the location and density of the corneal opacity are the chief and annoying symptoms of which the patient complains. Females are more often affected than males, and usually at the second dentition or at beginning of menstruation. Authorities differ somewhat, but most agree that 60 per cent. of all cases are due to inherited syphilis, although the gouty, rheumatic, scrofulous, and lymphatic diatheses, as also malaria and infectious fevers, are occasional etiological factors. The corneal opacity begins as a faint cloud usually at the centre and occasionally at the periphery, and spreads throughout the cornea. Under a magnifying glass the opacity appears more dense or white in spots. The density of the opacity causes a corresponding dimness of vision to the extent that in some cases there remains only the ability to recognize form or light and shade. Besides the deep (parenchymatous) opacity of the cornea there may be vascularization also, known as the "salmon patch." Iritis may be, and often is, a serious and associated condition, as also an inflammation of the entire uveal tract (retina and choroid). The presence of the Hutchinson teeth (notched), together with the facies of inherited syphilis, add to a positive diagnosis. The treatment must be local as well as constitutional. Locally, atropine solution must be used from the very beginning and extensively to keep down intra-ocular inflammation, which is so destructive to ultimate vision. Dark glasses for protection from bright light are needful. Constitutionally mercury is the most valuable drug we have for this disease, and it must be used heroically and gradually pushed to the point of pyalism. It is astonishing the

amount of mercury which these patients will bear. Gray powder internally is highly recommended by some, but most authorities extol the use of mercurial inunctions, beginning with one dram of blue ointment, to be applied each night and morning, and increasing this amount by one-half or one dram each third day until symptoms of mercurialization become evident on the gums or bowels. If possible the patient should rub in the ointment, otherwise the attendant or nurse might absorb an unpleasant amount of the drug. Whoever applies or rubs in the ointment should be instructed to rub it in thoroughly for ten or fifteen minutes. The axillæ, groins, and flexures at the elbows and knees may be selected as the places for rubbing, and seldom is the same place used after the skin begins to show irritation. It is always well to go from one place to another until the first place has recovered from soreness, when the ointment may be reapplied as before. If the nurse applies the ointment she should wear rubber gloves. A very good method is to use a smooth flat glass, as the stopper from a cologne or salts bottle. Placing the ointment on the skin, the operator holds the stopper by the neck and with the smooth, flat top rubs the medicament into the skin gradually but firmly. The patient's bowels must be kept open with a mild saline laxative, or in some cases Epsom salt acts well. The diet should be most generous, milk and eggs principally. No coffee, tea, or malt liquors are allowed.

An out-of-door life with proper shading of the eyes is of the very greatest importance. Some authorities claim that the outdoor life is of greater importance than the use of mercury. I insist upon both, and, in fact, treat cases of interstitial keratitis as the physician treats tuberculosis, so far as the outdoor life is concerned, including sleeping out-of-doors, with moderate exercise, permitting no mental worry or fatigue of any kind. Very few severe cases of this disease clear up sufficiently, so far as the cornea is concerned, to obtain normal visual acuity, with or without glasses, and the remnants of the opacity and vessels can be seen with a magnifying glass years afterward. When the eye becomes quiet, the remaining corneal opacity can be made to clear up somewhat by the use of dionin as elsewhere recommended for corneal opacities due to other causes. The ointment of the yellow oxide of mercury used daily by massage is a good stimulating treatment to promote absorption after all inflammation has subsided. If a central corneal opacity persists, an iridectomy must have consideration. Tuberculin should be employed in tuberculous cases. Quinine and arsenic are to be used as tonics and for malarial cases. Antirheumatic remedies are needful in rheumatic patients.

Buphthalmos (*Bull's Eye; Hydrophthalmos; Keratoglobus; Globular Cornea; Megalocornea; Glaucoma Congenitum*).—This gradual enlargement of the eyeball in all directions may begin in intra-uterine life or soon after birth. The exact cause is not known, although some think it is in the nature of tuberculosis. Eserine and pilocarpin in weak solution may be used once or twice a day indefinitely, and the eyes protected from bright light with dark glasses. The operation of iridectomy

is not highly advocated. The general condition of the patient must be carefully watched in every particular.

Scleritis.—This inflammation appears either superficially (episcleritis) affecting the episcleral tissues, or as a deep inflammation of the sclera itself, and while either variety may be associated with kerato-iritis, this complication more often appears with the deep scleritis. Episcleritis is manifested by a more or less circumscribed inflammatory patch or area lying upon the sclera or over the tendon of the internal or external rectus muscle, without any great involvement of the deep structures. The inflammation often extends up to the corneal margin. Inflammation of the episcleral tissue is recognized as a disease of adults who are usually the victims of a rheumatic or gouty diathesis, or of overindulgence at table. Usually one eye alone is affected, though both eyes may suffer, one generally in advance of its fellow. Relapses are frequent, and one attack does not produce immunity by any manner of means. The disease may begin acutely, but runs a chronic course, extending over weeks and months, and often with exacerbations or relapses without any apparent cause. While it is not always possible to find a definite cause for this scleral inflammation, yet as the rheumatic state or condition so often underlies so many of these cases, it is wise to begin free purgation with calomel and salts and then administer the antirheumatic remedies to the point of tolerance. The salicylate of ammonium, or strontium, should be given in 10 grain doses every two hours. Free diaphoresis with pilocarpin or an electric cabinet sweat given every day or two. Colchicum is an excellent remedy. L. Webster Fox and Bickerton, of Liverpool, recommend the following.

R—Decoct. aloes comp. f ʒij
 Elixir ferri comp. f ʒ viij—M.
 Sig.—One tablespoonful three times a day after meals.

If the scleritis does not yield to this persistent antirheumatic treatment, then the tuberculosis element must be considered and prescribed for if the case appears to demand it. As some few cases are specific, this fact must not be lost sight of, and antisiphilitic remedies (ointment of mercury) prescribed. The alterative treatment appears to do good in some cases which are not positively syphilitic.

Locally the eyes must be kept at rest with atropine, dark glasses, and a soothing eye wash.

Iritis.—While an inflammation of the iris occurs as a primary affection, it is very often associated with inflammation of neighboring structures, such as the cornea (kerato-iritis), ciliary body (iridocyclitis), and with the ciliary body and choroid (uveitis). The causes of iritis are innumerable—rheumatism, syphilis, diabetes, gout, tuberculosis, gonorrhea, traumatism, etc. The disease manifests itself by pain in the eyeball, generally much worse at night, intense photophobia, and associated lacrymation, with the visual acuity more or less impaired. Aside from the causes which usually characterize the variety of the iritis, the classification is generally in accord with the pathology—namely, simple plastic (acute or chronic), serous, and parenchymatous or purulent.

Syphilis as the cause of iritis is variously estimated at from 30 to 60 per cent. This seems rather high, and others estimate that rheumatism as a cause is much more frequent than syphilis. In my experience it would seem as if there were just as many cases of iritis due to syphilis as to rheumatism, and that iritis from other causes is relatively rare. Occasionally iritis appears without apparent cause.

Simple or Plastic Iritis.—This is seen as acute, subacute, or chronic. It is the most common variety of iritis, and, as its name implies (plastic), the iris soon after the hyperemia sets in begins to throw out a plastic exudate into the pupillary space and into the aqueous humor. This exudate gives iritis one of its chief dangers—namely, that the exudate may fill up the pupillary area, forming a membrane which cuts off the vision and at the same time may bind the pupillary edge of the iris in whole or in part (synechia) to the anterior capsule of the lens. If the pupillary space is thus blocked by this exudate the vision may be reduced to mere light perception, or if the iris is adherent to a great extent then glaucoma (secondary) may develop. The treatment of iritis is self-evident, *i. e.*, to put the iris and ciliary body at rest and to treat the cause. Atropine solution (1 per cent.), one or two drops, is to be dropped into the eye every two or three hours until mydriasis is complete. This condition of mydriasis must be maintained until the eye becomes perfectly free from all inflammation. It is wise to anesthetize the eye with a drop of a 4 per cent. solution of cocaine a few minutes before instilling the atropine, as this hastens the action of the atropine and its more ready absorption. The atropine solution should always be used warm, never cold. It may easily be warmed by standing the bottle in some warm water, or another good way to warm it is to hold the medicine dropper (containing some of the solution) over and above a flame for a few minutes. This should always be tested on the finger before dropping it into the eye, to make sure it is not too warm. I often drop a crystal of the atropine on to the cornea after using the cocaine. Whenever atropine is used the patient should be instructed to hold the punctum, or tear duct, closed with the end of his finger for a few minutes and thus save the annoyance of a dry throat, from having the drug find its way into the nares and pharynx. Some few writers recommend a solution of scopolamine (grains $\frac{1}{2}$ to $\frac{3}{4}$), but personally I do not recommend it on account of its toxic effect, unless it is used with extreme care. Dionin solution (5 per cent.), or in crystal, may be used, with the utmost satisfaction, to relieve the pain, and it also assists the mydriasis and absorption of the exudate.

The application of gauze pads wrung out of hot water as hot as can be borne, and changed frequently for a few hours, gives great relief in most cases. Leeching the corresponding temple with live leeches or the artificial (heurteloup) is of advantage if the eye is unusually inflamed and painful. If the pain becomes excruciating in spite of the treatment given, it may be necessary to resort to morphine given hypodermically. Subconjunctival injections of normal salt solution or a solution of bichloride of mercury (1 to 5000) are highly recommended, and may be

repeated every day, or every other day, if necessary. Cyanide of mercury, in the same strength, has its advocates. Internally the antirheumatic remedies must be pushed to the point of tolerance, aspirin or any of the salicylates if the case is rheumatic, or if specific, mercurial inunctions must be pushed, or the red iodide given, and the iodide of potash given in increasing doses, running up as high as one, two, and sometimes three drams a day if the patient's stomach does not rebel. It is an interesting fact that many of these cases take this dosage without discomfort after the first symptoms of iodism disappear. Some patients are rheumatic as well as syphilitic, and therefore they do well on both kinds of treatment. The physician must therefore prescribe for the most conspicuous condition. The gonorrheal cases do well on the iodide of potash, with small doses of mercury. Every case of iritis must be thoroughly purged and the bowels kept open. Due attention must be paid to the diet. The eye must be protected and the patient given plenty of fresh air under definite precautions against taking cold. Hypodermic injections of gonococcic serum for gonorrheal iritis did not produce any improvement in one case under my care. Hot packs, or pilocarpin sweats ($\frac{1}{8}$ to $\frac{1}{4}$ grain hypodermically), or an electric light sweat, are of marked benefit in some case of rheumatic iritis, as also in the gonorrheal type.

Serous Iritis or Uveitis, or Serous Cyclitis (*Keratitis Punctata; Descemetitis; Aquocapsulitis*).—This variety of iritis is frequently a manifestation of the same diseases which cause the plastic iritis. Every case of serous iritis should be carefully examined for any sinus disease which may be causing it, as it is now a well-established fact that frequently this disease arises from an inflammation in an approximate sinus. Serous iritis, in fact, is now recognized as arising from a microbic excretion from the ciliary body (Sidney Smith). Other authorities believe that women with uterine affections are predisposed to this form of iritis.

The exudate in serous iritis is serous in character, and is recognized in the form of small opaque dots deposited on the posterior surface of the cornea (Descemet's membrane) and into the anterior capsule of the lens. As these deposits rest upon the posterior surface of the cornea they arrange themselves in the form of a triangle with the base downward. Pain, photophobia, and lacrymation are not nearly so severe as in the plastic variety, as a rule. It is truly a chronic disease. The treatment, while similar to the plastic, is not usually so energetically pushed, as many of these patients require a building-up treatment also. In other words, they must not have any treatment that puts them below par. Fresh air, tonics, and a generous diet are indicated in almost every instance. Mercury must be prescribed if the patient is syphilitic, but the mercury is not to be pushed to any great extent unless the patient happens to be robust. The sinuses must be treated if necessary. The treatment by "nasal tamponades," as suggested by J. Ivimey Dowling and Charles E. Terry (saturating a well-wrapped pledget of absorbent cotton and soaking it in a solution of argyrol (grains xl to $\frac{3}{4}$), and packing this well up the nares of the affected side and leaving it there for ten or twenty minutes, repeating this two or three times a day)

is a most valuable and highly extolled treatment for sinusitis. Its beneficial action on all kinds of intra-ocular inflammations, choroiditis, cyclitis, etc., certainly merits the consideration of all ophthalmologists. Any uterine complication must have due care. Iodides in any form or the syrup of the iodide of iron, or syrup of hydriodic acid (one dram) three times a day may be prescribed. Atropine in moderation is to be used cautiously for fear of setting up a glaucoma. Glasses of dark shade to protect the eyes in bright lights are always necessary. Pilocarpin sweats ($\frac{1}{8}$ to $\frac{1}{4}$ grain hypodermically), or a sweat by one of the cabinets, gives great benefit in many cases.

Parenchymatous, Purulent, or Suppurative Iritis.—This variety of iritis is not of such frequency as the plastic and serous forms. It may be a late manifestation of syphilis, appearing as yellowish-colored nodes in the parenchyma of the iris, and it may also appear as a manifestation of diabetes, or in pyemia, septicemia, typhoid fever, influenza, meningitis, etc. The local treatment must be identical with that for the plastic variety, and the constitutional treatment applies to the underlying cause—syphilis, diabetes, etc.

Cyclitis.—This rarely occurs as a distinct disease, as it is usually associated with inflammation of the iris (iridocyclitis), and appears in the plastic, serous, and purulent forms, as described under the various forms of iritis. As the causes and treatment of the various varieties of cyclitis are quite identical to those of the corresponding iritis, the reader is referred to these subjects.

Choroiditis.—In the study and treatment of the diseases of the choroid it must be remembered that this is the vascular and pigmented tunic of the normal eye, and that the retina, vitreous, and lens depend upon the normality of the choroid for their nutrition, and therefore any interference with this structure means eventually some manifest changes in these three dependent structures.

The varieties of choroiditis are many—namely, acute, chronic, superficial, deep, plastic, serous, central, disseminated, circumscribed, suppurative (purulent), non-suppurative (exudative), metastatic, syphilitic, tuberculous, etc. The course, duration, and extent of the disease may, and very likely will, require some particular attention, and yet, like most cases of iritis, there is a certain line of treatment which is more or less uniform. The eye must be put at rest with atropine and properly shaded. Most authorities recognize the fact that nearly all cases of choroiditis are due to syphilis or sinusitis. If syphilis is suspected as causing the choroiditis, then the use of mercury and iodides should be commenced and pushed vigorously. The bowels must be moved freely and any necessary depletion by taking blood from the temple must be resorted to. Diuretics and diaphoretics must have consideration, and if the patient is anemic or the subject of malaria or tuberculosis or sinusitis, these factors must be coped with.

The juxtaposition of the retina to the choroid frequently brings on an inflammation of this structure also (retinochoroiditis), but this does not alter the treatment. Whenever atropine is used to combat inflam-

mation in the eye or to put the eye at rest it is always well to test the tension from time to time, to make sure that the intra-ocular tension does not become increased.

Tuberculous Choroiditis.—This is an extremely rare affection, and the eye requires very little treatment. Injections of tuberculin (T R) are recommended by von Hippel and others. I have had no experience with this treatment of choroiditis.

Retinitis.—Inflammation of the retina, like that of any other intra-ocular structure, can only be definitely recognized by the use of the ophthalmoscope. The chief symptom of retinitis is defective vision, but as defective vision may be produced by corneal abnormalities and diseases, lens changes, and vitreous clouds or opacities and various inflammations of other ocular structures, it is always necessary to inspect the interior of the eye for proof of the condition. Successful treatment of any disease must be the treatment of the cause, and so it is in retinitis. The retina is subject to inflammation as the result of numerous diseases and conditions. Albuminuric retinitis and retinitis from diabetes are the two principal varieties. It is generally recognized that kidney changes do not manifest themselves in the retina in every case; in fact, only about 25 per cent. of Bright's disease cases have retinal changes. Retinitis is often a late manifestation of diabetes. Retinitis often accompanies choroiditis. Retinitis is a part of the condition associated with choked disk in brain tumor. Inflammation of the retina may result from an inflammation of one of the neighboring sinuses. It has also been attributed to caries of the teeth. Infectious fever, malaria, meningitis, rheumatism, gout, syphilis, injuries, etc., are a few of the causes of this disease, as also eye-strain, reflected and direct light and heat.

The treatment of retinitis is directed chiefly to the underlying cause, although at the same time the eye must be protected by dark glasses and rest. Atropine is to be used unless contra-indicated by glaucoma.

Retinal Asthenopia.—Fatigue of the retina is more often due to an error of refraction than any other cause. It is also a symptom of hysteria. Tobacco and the use of alcoholic beverages in excess are some of the other causes. When due to a refractive error this must be promptly corrected with suitable glasses and usually under a cycloplegic. Tobacco and liquors should be interdicted. Hysteria requires its appropriate treatment.

Blindness due to snow, sunlight, electric light, or moon are usually only temporary. The patient should be put to bed in a dark room, purgatives administered, and cold compresses applied to the eyes. These cases recover promptly, as a rule, but if the macula has been damaged there may be a permanent defect in the vision. If this danger threatens it will be necessary to abstract blood from the temples and to use atropine, and to administer small doses of mercury, to be followed by the use of iodides. The eyes must be given a prolonged rest.

Retinal Hemorrhages.—Hemorrhages in the retina are usually an associated condition, with inflammation, but they also occur as a distinct condition. The constitutional cause must receive appropriate treat-

ment, but purgatives, absorbents, rest in bed, and rest of the eyes are absolutely necessary in all cases.

Retinitis in albuminuria and diabetes must have the rest treatment, as just mentioned, but the general treatment is the chief factor and must be constantly watched and applied. The prognosis is always grave.

Syphilitic Retinitis.—The rest treatment is very important, but the chief reliance must be placed upon the vigorous use of mercury and the iodides. This variety of retinitis is usually seen in the cases of acquired syphilis, but occasionally the disease is inherited.

Retinitis (gouty and rheumatic) must have the antirheumatic remedies—alteratives and tonics. Many of these cases appear among old subjects who need building up.

Retinitis Pigmentosa.—There is very little encouragement to be gained from any treatment of this unfortunate condition. When syphilis is suspected the syphilitic remedies should be thoroughly tried. The use of the constant current is recommended, but authorities are not enthusiastic in recommending this or any other treatment.

Thrombosis of the Retinal Artery or the Central Retinal Vein.—In the former condition it has been recommended to gently massage the eyeball and to do a paracentesis if the case comes under observation quite early, but as most cases appear rather late, mercury and iodides should be prescribed for their absorbent qualities. Sweats and purgatives may do good if the case comes under observation during the first week, but if not seen for three or four weeks the prognosis is very unfavorable for any line of treatment. In the latter condition the patient should be kept quiet, purged, and his diet carefully regulated. Iodides are recommended, and in some cases strychnine has been of benefit.

Detachment of the Retina.—To permanently replace a detached retina has been the effort of the medical profession for years. The cases of permanent reattachment are very few. When the detachment is due to a growth it is useless to attempt any treatment short of enucleation if the growth is malignant. When due to high myopia or trauma there is some hope. The patient must be put to bed promptly, with the head elevated; the head must not be lowered under any circumstances. Atropine must be instilled into the eye, and the eye kept at rest. Purgatives must be given freely. The patient to be sweated with hot packs or by pilocarpin. Subconjunctival injections of normal salt solution are useful so long as they appear to do good. The surgeon must examine the interior of the eye to note any changes or signs of reattachment. The treatment should be persevered in if the case has come under observation early. If seen several weeks after the condition has developed, or if improvement or reattachment does not take place in two or three weeks, it is not necessary to persevere longer with medical treatment. Dionin has been highly extolled in place of the salt solution, and in one instance under the writer's experience it acted almost miraculously.

Detachment occurring in the course of weak heart, giving what is sometimes spoken of as edema of the retina, must be treated with the

condition of the heart under consideration. In such a case depressing treatment with pilocarpin would be contraindicated.

Panophthalmitis.—Free purgation with salines and mercurials must be instituted at once. The patient is put to bed and hypodermics of morphine given if the pain is severe. Very few eyes having this inflammation of all structures are saved, and they must be enucleated sooner or later.

Sympathetic Inflammation, or Ophthalmia.—Just how an inflammation in one eye will cause a sympathetic or similar inflammation in the fellow eye is a disputed question. However, the condition unfortunately does exist at times, and must be treated heroically. The exciting eye, or the eye having the primary infection, usually from some foreign substance, should have this foreign matter removed if possible. As soon as inflammation appears in the sympathizing eye it is the general practice to remove the exciting eye if inflamed, no matter how good its vision may be. The patient should be placed at rest in bed, the eyes placed under the influence of atropine, and the room darkened. Leeches are applied to the temple and cold cloths to the eyes. Purgatives are administered, and mercurial inunctions employed. Salicylates must be pushed to the point of tolerance if the stomach will permit. Iodide of potash should be given later if there is any sign of improvement.

Glaucoma.—Simple glaucoma, either in its early stages or in the chronic state, the so-called non-inflammatory variety, requires the local use of myotics, either eserine sulphate (grains j or ij to ʒj), or pilocarpin hydrochlorate (grain $\frac{1}{2}$ or j to ʒj). The myotic is to be dropped into each eye two or three times a day. The eyes should be given as much rest as possible, and any ametropia should be corrected with appropriate glasses. The bowels must be kept open and the diet regulated. No excesses in food or drink should be permitted. It is good treatment to give freely of the salicylates, as many cases of glaucoma appear among the gouty and rheumatic. Iodides may be prescribed for the same reason. Whenever eserine sets up a conjunctivitis it is well to stop its use and resort to pilocarpin. In old subjects pilocarpin appears to have a better influence by being less irritating to the conjunctiva.

Inflammatory glaucoma does not yield so readily to the above-mentioned treatment as the simple variety, and while the same treatment should be tried, yet operative measures must be employed. Morphine should be given hypodermically if the pain become severe. General systemic treatment must always be employed also. It is good practice to use the myotic in each eye. This is important.

Papillitis (Choked Disk; Papilledema).—The treatment of inflammation of the optic nerve head depends upon the recognition of the cause. Brain tumor causes choking of the disk in 85 per cent. of all cases. Bright's disease frequently causes papillitis (neuroretinitis) and usually in both eyes, as in the typical kidney changes incident to pregnancy. Syphilis is another common cause. Of the other causes to be mentioned are meningitis, anemia, disturbed menstruation, orbital tumors, diseases

of neighboring sinuses, metallic poisons, lactation, heredity, and injuries.

Antisymphilitic treatment should be pushed to the point of tolerance when a brain tumor has been diagnosticated, as occasionally this treatment produces marked improvement. It can do no harm, and it is always well to try it before proceeding to surgical treatment. When the papillitis is due to kidney changes, then the kidneys should receive immediate and appropriate treatment. If due to malaria, quinine and arsenic are indicated, and for the anemia fresh air and tonics and a building-up treatment are desirable. When all treatments appear to fail and blindness threatens, then a decompression operation must be considered.

Acute Retrobulbar Neuritis (*Central Amblyopia; Orbital Optic Neuritis*).—Fortunately this is not a common malady. It is usually unilateral. It may be caused by syphilis, rheumatism, acute alcoholism, taking cold, suppressed menstruation, extension of inflammation from neighboring sinuses, diabetes, eruptive fevers, and occasionally it is idiopathic. Aside from the appropriate treatment for the underlying cause, good results follow from pilocarpin sweats, the use of salicylates, or the mixed antisymphilitic treatment.

Chronic Retrobulbar Neuritis (*Toxic Amblyopia; Tobacco Amblyopia*).—The prolonged use of tobacco and alcohol frequently produce this variety of neuritis, and it is therefore much more common among men and after the age of forty years. Other toxic agents which produce this condition are wood alcohol, essence of ginger, lead, iodoform, chloral, opium, arsenic, stramonium, bisulphide of carbon, dinitrobenzol, diabetes, syphilis, etc.

The first step in treatment is the withdrawal of the drug or drugs causing the disease. Exercise in the open air must be insisted upon, also the best of nourishing food (eggs, milk, etc.), strychnine or nux vomica in increasing doses to the point of tolerance, and then to gradually withdraw the medicine by correspondingly decreasing the quantity. The eyes should not be taxed in any way, and must be shaded with appropriately tinted glasses, preferably the Fieuzal tint.

Optic Atrophy.—This occurs either as primary (gray degeneration) or secondary, the former being unassociated with a previous inflammation of the nerve, while the latter is the result or termination of an inflammation of the nerve (postneuritic atrophy). Very little can be accomplished for the restoration of the nerve to its normal condition, and the treatment must be directed to the underlying cause. Sweats, either by pilocarpin or the electric light, as also the use of mercury and iodides, must be employed. Galvanism is recommended. Strychnine by stomach or by injections is recommended also. The interrupted x-rays have a few advocates, but I have never seen a case of true atrophy improved by this treatment. Inhalations of oxygen gas had favor for a short time, but there is no virtue in it for rejuvenating atrophic nerves. Nitroglycerin has its advocates also.

Paresis and Paralysis of the Ocular Muscles.—The causes of ocular paresis are chiefly syphilis and rheumatism. Other causes may be

injuries, brain tumor, diphtheria, suppressed menstruation, etc. The underlying cause affects either the nerves of innervation directly, or they are pressed upon by inflammation in the bony canals or in the periostium that surrounds the foramen as the nerves pass from their central origin into the orbit. The prognosis depends upon whether the patient comes under observation early, before changes have taken place in the nerve, or whether he appears after structural changes have developed.

The treatment is local as well as constitutional. Local in that the affected eye must be covered with a shield of ground glass or a patch, so that diplopia may be prevented. This is especially important if the patient goes upon the street. Specific medication must be prescribed if indicated, and, even when it is not indicated by the patient's history, it is often necessary for its alterative effect, particularly in rheumatic subjects. The iodide of potash should be pushed to the point of tolerance, and often it is well to combine it with mercury given internally or by inunctions. The bowels must be kept open, and Turkish baths should be taken two or three times a week.

The interrupted galvanic current or the faradic current is of value in some paretic cases. The eyeball is cocainized and the negative pole placed over the tendon of the muscle, or, what I prefer, is to apply it to the eye over the closed lids. However, it is questionable how much benefit the electric current accomplishes. I place more reliance on internal medication. Strychnine or nux vomica may be tried as a late expedient.

The accessory sinuses should always be inspected, and any irritation or pressure should be relieved.

REFRACTION OF THE HUMAN EYE.

Normal Refraction.—The eye is said to be normal, or standard, or emmetropic, when rays of light from a distance of twenty feet or more (from infinity) pass into the eye and are focussed upon the retina without any effort on the part of the muscle of accommodation. In other words, when the ciliary muscle is at rest and the eye can see distinctly at a distance without the aid of any artificial lens, then that eye is spoken of as normal in its refraction—its retina is situated exactly at the principal focus of its dioptric apparatus (Fig. 66¹).

The eye which possesses normal refraction does not need any glass for any ordinary work until the ciliary muscle (muscle of accommodation) begins to lose its power, and this usually becomes manifest at the age of forty-five. This condition is known as presbyopia, or old sight. Glasses for eyes having emmetropic refraction in the presbyopic age are only ordered to assist near or reading vision, and not to assist distant vision, as this latter is already standard, and glasses will not improve its visual acuity.

¹ Figures from *Refraction and How to Refract*. Fifth edition, Thorington. V V, vertile meridian, and H H, horizontal meridian.

Abnormal Refraction.—Abnormal refraction means that an eye in a state of rest does not receive parallel rays of light at a focus on its retina. The parallel rays as they enter the eye of abnormal refraction either

FIG. 66

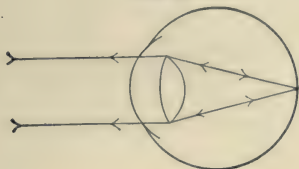


FIG. 67

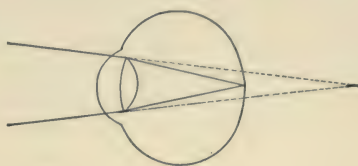


FIG. 68

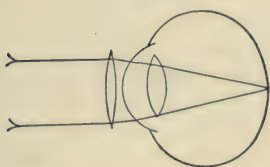


FIG. 69

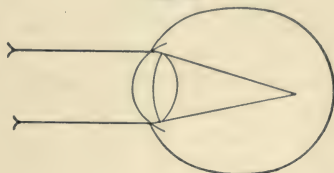


FIG. 70

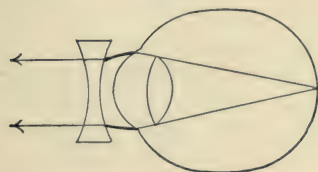


FIG. 71

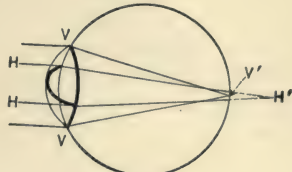


FIG. 72

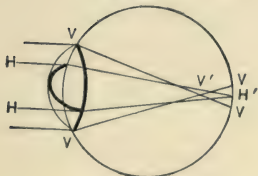


FIG. 73

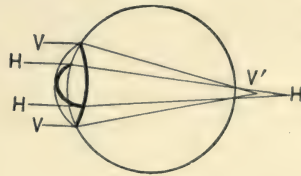


FIG. 74

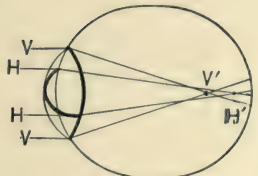
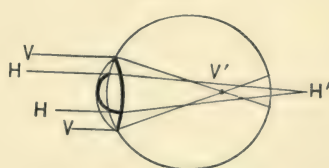


FIG. 75



focus in front of the retina or back of it, or some of the rays may focus upon the retina while others may focus either in front or back of it. An eye at rest which has its retina situated in front of its principal focus is

known as the simple hypermetropic eye (Fig. 67), and requires a convex spherical lens to bring it up to the standard or emmetropic condition (Fig. 68). This eye is commonly spoken of as far-sighted and the eye of nature, because most birds and animals possess such a refractive condition and have to accommodate to see at all distances.

An eye at rest which has its retina situated back of its principal focus is known as the simple myopic eye, and this eye is spoken of as near-sighted, or myopic (Fig. 69), and requires a concave spherical lens to give it a normal or emmetropic refraction (Fig. 70). The myopic eye is therefore the reverse of the eye of nature, and is occasionally spoken of as the eye of civilization (Fig. 68).

About 20 per cent. of all eyes, according to statistics, require convex spherical lenses and about 1 per cent. require concave spheres, and standard eyes are extremely rare. About 79 per cent. of all eyes have a refractive error which is known as astigmatism. Astigmatism is a condition in which rays of light from infinity passing into the eye or through a lens do not meet at a focus, but they come together in two planes, one in front of the other. The result is that an eye which is astigmatic in its refractive error requires a lens (cylinder) which will make parallel rays come to a focus in one meridian. Cylinder lenses are either convex or concave. An eye which requires a convex cylinder to give it standard vision has simple hyperopic astigmatism (Fig. 71). An eye which requires a concave cylinder to give it standard vision has simple myopic astigmatism (Fig. 72). An eye which requires both a convex sphere and cylinder to give it standard vision has compound hyperopic astigmatism (Fig. 73). An eye which requires a concave sphere and cylinder has compound myopic astigmatism (Fig. 74). An eye which requires a concave and also a convex cylinder with their axes usually at right angles to each other has mixed astigmatism; this combination of two cylinders is usually reduced to a sphero-cylinder combination (Fig. 75).

Presbyopia.—This condition is known as "old sight," and is the penalty for growing old. It is recognized as one of the early signs of senility. It is an interesting fact that the power of the muscle of accommodation, the focussing power of a standard eye, is half gone at thirty years of age. In other words, the eye is the first part of an otherwise healthy individual to show the effect of age. An emmetropic eye at ten years of age has a focussing power of 14 diopters, but at the age of thirty years there are only 7 diopters left, and this gradually diminishes with succeeding years until at the age of seventy years the power of accommodation is practically nil. As very few eyes are emmetropic, it therefore follows that most eyes which are presbyopic require two pairs of glasses—one pair for distant vision and another pair for near vision—hence, most presbyopic patients wear what are known as bifocal lenses.

Principles Involved in Fitting Glasses.—The most convex surface of every lens should be placed outward, and the most concave surface of every lens should be placed inward, next to the eye; or, to state the fact in another way, the least convex surface of every lens should be placed next to the eye, and the least concave surface should be placed

outward, or away from the eye. The lens surface should be placed as close to the eye as possible without touching the eyelashes; if these are extremely long, it may be necessary in such instances to trim off the tiny ends. The centre of the lens should be placed over the centre of the pupil. These may seem like trifling matters, but they are of great importance. The best efforts of the most skilled ophthalmologist may be frustrated in giving comfort to the patient's strained eyes if the optician makes an error in any one of these particulars; hence it is important that every pair of glasses be carefully inspected by the prescriber before they are worn. Glasses which are prescribed for constant use are usually placed with their surfaces at right angles to the line of vision, but if the glasses are to be worn at close work only, then the line of vision will usually be downward and forward, as in the act of reading a book held in the lap; in this instance the glasses should be tilted forward at the top about 10 or 15 degrees to meet this position. When prescribing bifocals, a compromise must be made in this regard, and the bifocal lens tilted forward at the top some 8 or 10 degrees, so that when the patient wishes to see clearly at a distance with the top part of the bifocal he must hold his head upward or erect. Many patients get round-shouldered wearing bifocals if not properly adjusted. The size of the lenses depends upon the distance between the pupils and the occupation of the patient. If the patient has a long interpupillary space, then he can usually wear large lenses; but if the interpupillary space is small, then small lenses will be required, or else the centre of the lenses will have to be especially made. Such occupations as playing golf, tennis, or riding in an automobile, or playing the piano, make it necessary to have the lenses large, so that the edge of the lens does not come prominently into view. Toric lenses are an advantage on this account, but some sensitive eyes cannot endure the additional light which toric lenses permit to enter the eye. Such eyes must have the plano lenses, not toric.

PART X

THE TREATMENT OF DISEASES OF THE EAR AND TYMPANIC MEMBRANE

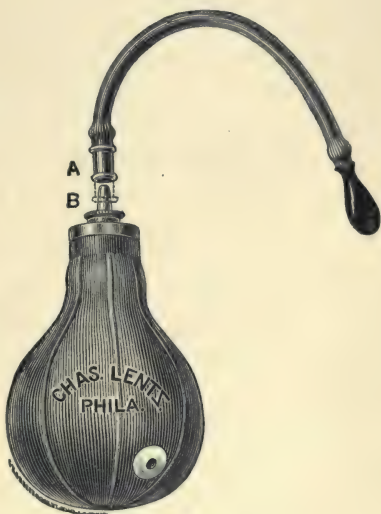
BY S. MACCUEEN SMITH, M.D.

GENERAL THERAPEUTICS OF THE EAR.

To successfully treat diseases of the ear it is necessary to inquire into and correct the underlying pathological conditions existing elsewhere in the economy, as the application of topical treatment only, with failure to recognize or consider these pathogenic factors, will not produce the desired results in a considerable proportion of aural cases. The general diseases to be noted in this connection are rheumatism, Bright's disease, the anemias, gout, and nervous conditions. Pathological states of the nose and throat have a greater bearing on the ear, however, than any of these systemic diseases. To treat a patient for deafness alone when there is imperfect nasal respiration, due to deflected septum, diseased tonsils, adenoids, enlarged turbinates, or polypoid growths, would be to make an utter failure. Furthermore, an inquiry should be made as to what medicines the patient has previously taken, because such drugs as quinine, the salicylates, opium, alcohol, and others cause marked aural symptoms in susceptible individuals.

Politization.—Probably the most commonly used, and at the same time the most abused instrument employed in the treatment of diseases of the ear is the Politzer bag. The use of this instrument, alone or in connection with the Eustachian catheter, with too much force, may cause rupture of an atrophic tympanic membrane or concussion of the

FIG. 76



Politzer bag.

labyrinth. Then, again, it not infrequently happens that the middle ear is infected by forcing pathogenic secretion from the nasopharynx through the Eustachian tube; or the middle ear may become involved by inflation during the early state of an acute otitis media. It is well, therefore, that inflation should not be practised during acute nasopharyngeal disease or until the cessation of the more acute symptoms of an otitis media.

The objects to be accomplished by inflation with this bag, when properly used, are: (1) Separation of the walls of the Eustachian tube, permitting free ventilation of the tympanic cavity; (2) to hasten the absorption of exudates within the tympanic cavity; (3) to break up middle-ear adhesions and to stretch the contracted tensor tympani muscle; (4) to restore the membrana tympani and ossicular chain to a more normal position, thereby relieving the labyrinth of undue pressure; and (5) to preserve the flexibility of the membrana secunda. In addition to this, various medicaments may be introduced through the catheter.

To use the Politzer bag, the nasal tip is introduced into one nostril, while the nose is compressed laterally so that the other nostril is occluded. The patient is then directed to inflate the cheeks, with the lips tightly compressed, to say "k," or to swallow, the object being to close off the postnasal space and thus prevent the escape of air into the throat, while the operator simultaneously compresses the bag. If a small amount of chloroform vapor is drawn into the bag the procedure is rendered easier, less force is required to produce the inflation, and in addition the chloroform vapor has a beneficial effect on the tympanic mucosa.

FIG. 77



Eustachian catheter.

Catheterization.—In using the catheter even greater care must be exercised, as faulty technique here may do considerable damage to the mucous membrane of the nose. The instrument is introduced point down and carried along the floor of the nose until it touches the posterior wall of the pharynx. It is then turned toward the opposite side and brought forward until it touches the posterior end of the septum. Again, it is turned on its axis until the ring points toward the external canthus of the eye on the side that is to be inflated. If the point is now pushed outward it will engage in the pharyngeal end of the tube. The tip of the Politzer bag is fitted into the end of the catheter and the bag compressed. Before this, however, if medication is to be applied to the Eustachian tube and middle ear, it should be forcibly injected into the catheter by means of a small medicine dropper, usually four or five drops being sufficient. It is of the greatest importance that thorough aseptic and antiseptic precautions should be taken in using the catheter,

and this should include rendering the nasal chambers and nasopharynx as sterile as possible.

Pneumomassage.—A valuable adjunct to inflation through the tube is pneumomassage of the drum membrane and ossicles through the external auditory canal, and the instrument best suited to this purpose is Sieglé's pneumatic otoscope. This appliance has a lens at the large end, so that the mobility of the membrane and ossicles may be noted. The tip is introduced into the meatus in the same manner as a speculum, with the bulb compressed, so that the first result, when pressure on the

FIG. 78



Sieglé's otoscope.

bulb is released, will be to pull the membrane outward. After that it is alternately compressed and released rapidly but gently for two or three minutes.

Syringing.—The syringe is another instrument which is very commonly used, and, like the Politzer bag, may be the source of great harm when unskilfully handled. Great care must be exercised, as even when used with the least possible force, vertigo and nausea may be brought on in susceptible patients. The syringe is held in the right hand, and with the left the auricle is pulled upward, outward, and backward (or

FIG. 79



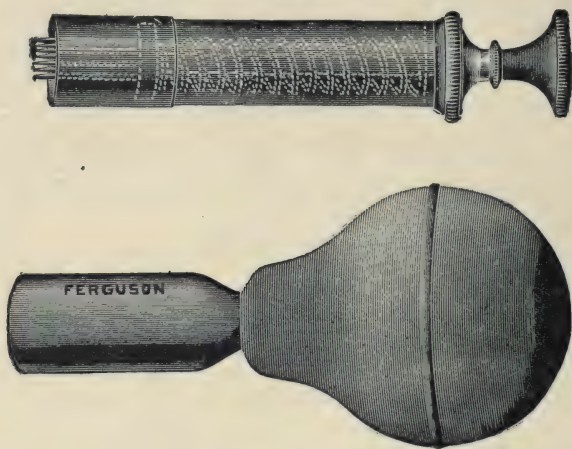
Ear syringe.

in an infant downward and backward) to straighten the canal. The tip of the syringe is then introduced just within the meatus and the fluid injected in a steady but gentle stream, the return flow dislodging the foreign body and causing its expulsion into the receptacle held tightly against the neck just beneath the lobule. In the case of foreign bodies or impacted cerumen, it is well to rotate the syringe so that the stream is directed along the canal, in that way going between the wall of the canal and the foreign body and more easily dislodging it, whereas, if directed straight in, the body may be forced against the tympanum.

Irrigation.—In some acute ear diseases, as well as occasionally in the chronic form, it is well that irrigation should be practised instead of syringing. By irrigation is meant the employment of the fountain syringe. The force can be accurately regulated by the height at which the bag containing the hot solution is placed above the head. For a prolonged application this is greatly preferable to the syringe. It is especially serviceable also in unskilful hands, or where there is danger of using too much force by means of the hand syringe. Generally speaking, the bag should not be placed more than 12 or 15 inches above the ear.

Application of Heat.—All fluids, whether for the purpose of irrigation, syringing, or in the form of drops, should be thoroughly warmed before being placed in the external auditory canal. Indeed, the benefit to be derived in some instances is almost wholly from the heat imparted, rather than from any medicinal properties that a given preparation may possess. The fluids, therefore, should be heated to the point of toleration, which varies in different subjects. In acute inflammations of the external and middle ear, the external application of heat gives a great deal of relief. For this purpose the hot-water bag or the old-time hot salt or hop bag is convenient and easily accessible; or by the use of electricity an even and continuous heat is obtained.

FIG. 80



Artificial leech.

Application of Leeches.—The extraction of blood from in front of the tragus is sometimes of the greatest service in the hyperemic stage of acute otitis media, but I do not consider it of much use in mastoid disease. Extraction of blood from the mastoid region does good, however, in some cases of acute labyrinthitis. The natural leech is serviceable for this purpose, but uncleanly, and a person whose methods are of questionable cleanliness is usually called upon to apply it. Better than

this is the artificial leech, as devised by Gorham Bacon, which consists of a scarifier and an extractor. Usually one or two extractors full of blood are withdrawn, after the skin has been scarified, and the wound is then cleansed with an antiseptic and sealed with collodion.

Application of Cold.—As stated in the following text, the mastoid process is more or less involved in virtually all acute inflammatory conditions of the tympanic cavity. With prompt treatment of the latter disease, the hyperemic state of the mastoid usually recovers itself. However, as a prophylactic, the application of continuous cold is frequently effective, and this is best carried out by the Leiter coil. In its

FIG. 81



Lleiter coil.

FIG. 82



Small mastoid ice-bag.

absence, however, an ice-bag can be used, more especially the small mastoid ice-bag devised for this purpose. In any event, the cold should be applied directly to the mastoid, never over the external meatus, and continued uninterruptedly for a period of twenty-four to forty-eight hours, but should never be replaced after removal; if it has not arrested the inflammatory process by this time, its use will prove negative, or may serve to mask symptoms, much in the same manner as would hypodermic injections of morphine.

DISEASES AND INJURIES OF THE AURICLE.

Perichondritis Auriculæ.—In so far as observation reveals, some of these cases are evidently idiopathic; the majority, however, result from some form of infection, such as furunculosis, or they may follow operations on the auricle, as well as complicate frostbites and syphilis. The septic form of the disease is rather rapid in its onset, whereas the syphilitic and idiopathic varieties develop much more slowly.

The disease manifests itself as an acute inflammation of the perichondrium, with a synovial-like effusion between the latter and the cartilage, usually more severe in the anterior part of the auricle, fre-

quently starting in the external auditory meatus as the result of a furunculosis, for which it is sometimes mistaken, and gradually involving the whole auricle. In consequence of the swelling, considerable deafness is observed from occlusion of the meatus, and owing to edema of the parts adjacent to the mastoid process the ear is sometimes pushed forward, the pain in many instances being severe.

The cavity of the tumor is usually filled with a thick, yellowish fluid and seldom contains pus. In well-developed cases much deformity follows destruction of the cartilage, it being difficult sometimes to differentiate between this disease and hematoma auris. In this stage the tumor is translucent, and the swelling is more or less uniform in character. Other distinguishing points from hematoma are the greater severity of the inflammatory symptoms and the slower development of the tumor, while in othematoma there is history of an injury, a rapid, irregular development, and the contents of the swelling are always blood at first. In the early stages the use of the hypodermic syringe to draw off the fluid would further aid in the differential diagnosis.

As the treatment of perichondritis auriculæ and hematoma auris is similar, both will be considered under the latter heading.

Othematoma.—Although a blood tumor of the auricle may be idiopathic, it generally develops as the result of injury, and is most commonly found in pugilists and football players. A striking exception to this rule would seem to be in the development of hematoma in the insane ("insane ear"), but personal investigation of this subject has convinced me that practically all the cases developing in insane asylums are the result of injury and are not a characteristic idiopathic index of the patient's mentality, as was heretofore believed.

The tumor appears suddenly, as the result of an extravasation of blood between the cartilage and the perichondrium following an injury. It is bluish red in color, opaque to transmitted light, irregular, and convex, occupying the anterior part of the auricle. In cases of severe injury the tumor may occlude the external auditory meatus, producing considerable deafness, and there may be some pain, heat, and tenderness. Great deformity frequently follows this disease, especially when not properly treated in the initial stage. In uncomplicated hematoma, suppuration rarely occurs.

As above mentioned, the treatment outlined will apply to both hematoma auris and perichondritis auriculæ, unless otherwise stated.

If the inflammation is not severe and the origin apparently idiopathic, a piece of gauze saturated with lead water and laudanum should be placed around the auricle, enveloping the entire surface both anteriorly and posteriorly, and pressure applied by means of an additional dressing and bandage. The same should be kept wet, the dressings being changed to observe the results of the treatment, this being all that is required in many simple cases. If, however, resolution does not promptly occur, a free incision should be made anterior to the concha, and posterior also if necessary, the contents of the tumor being thoroughly evacuated. It must be borne in mind that inasmuch as the deformity is caused by

absorption of the cartilage, and our only means of preventing this absorption is by early incision, a prompt evacuation of the tumor is advisable. This should be followed by antiseptic treatment of the wound and the continuation of slight pressure. Very little deformity will result when early incision and evacuation are practised, whereas neglect of this simple procedure may result in suppuration, with complete destruction of the cartilage and consequent deformity.

Some authors advise withdrawing the fluid by means of the hypodermic syringe and injecting into the cavity a solution of tincture of iodine one part, water two parts, which should be withdrawn in a few minutes. This does not, in my experience, produce the good results of the early incision, and would seem to be applicable only in mild cases, if at all.

When perichondritis is the result of syphilitic infection, antisymphilitic treatment should be vigorously pushed and incision avoided.

Frostbite.—The auricle sometimes becomes frozen as the result of exposure to extreme cold, when it assumes a yellowish-white color and may become quite brittle. The prompt reestablishment of the circulation is our chief object in the line of treatment, and this is best accomplished by placing the patient in a cool atmosphere and applying snow or cold water with gentle friction. The circulation being reestablished, warmer applications can be gradually substituted. In the absence of these simple measures, severe inflammation may result, in extreme cases leading eventually to gangrene, which may necessitate amputation. In the event of much skin excoriation, equal parts of zinc oxide and boric acid powder should be dusted over the surface, or an ointment of yellow mercuric oxide may be applied.

OBSTRUCTIONS AND DISEASES OF THE EXTERNAL AUDITORY CANAL.

Impacted Cerumen (Ear Wax).—It should be remembered that an occasional accumulation of wax within the external auditory canal does not necessarily imply that the ceruminous glands are diseased. If, however, there is a frequent collection of cerumen, it would indicate considerable inflammation of the cutaneous surface, which would stimulate the glands to increased activity.

Although the patient may only complain of unilateral deafness, or other sensations due to the presence of wax, it is always well to examine the other ear, as both are usually involved. The deafness is frequently caused by an attempt to remove the wax or to gratify an itching sensation by scratching the canal with a hairpin or other implement, with the result that the mass is pushed back into the canal and impinges upon the drumhead. So long as the obstruction does not completely fill the lumen of the canal, nor press against the membrana tympani, the hearing will not be greatly impaired. The patient, therefore, is often surprised when shown the large plug of cerumen that was removed from the good ear without having produced any impairment of hearing.

As a prophylactic, care should be taken not to put soap and water far into the canal, as this is the frequent cause not only of the accumulation of wax, but of many inflammatory conditions. The fastidious and extremely cleanly, on account of the above habit, are prone to this trouble.

The patient usually complains of a more or less sudden deafness, following picking or washing the ear, as above stated, the degree of deafness depending entirely on the size and location of the accumulation. Unless water or other fluid is introduced into the ear, the wax may become dry and hard and cause practically no disturbance, whereas the introduction of fluids produces considerable swelling and consequent deafness. This may follow the introduction of salt water into the external canal during sea bathing. It is frequently accompanied by a feeling of fulness in the head, and if the wax is impinging upon the drum-head, giddiness, tinnitus aurium, and various auditory hallucinations. Autophony is often a prominent symptom, and cough may be another symptom, sometimes caused by pressure upon the auricular branch of the pneumogastric nerve. An examination by means of the speculum shows a more or less obstructed meatus, with a grayish-brown or black mass, which may be either hard or soft, depending upon the amount of moisture present. It is well to distinguish between a plug of cerumen and a cholesteatomatous mass due to a chronic but semiquiescent otorrhea.

When the cerumen or epithelial plug is hard, it should first be moistened by the introduction of softening drops, composed of 15 grains of sodium bicarbonate to $\frac{1}{2}$ ounce each of glycerin and water, this to be warmed and dropped into the ear three times a day for one or two days, instructing the patient that a temporary increase in deafness will probably follow the instillation of these drops. It is impossible, in some cases where the wax is extremely hard, to accomplish its complete removal at the first sitting, in which event the patient should be directed to use the drops again, when the remainder can be readily removed. The best solution for syringing the ear is either a 1 per cent. warm solution of sodium bicarbonate or normal salt.

The illustration of a syringe (Fig. 79) shows the best one for this purpose, the idea being to straighten the canal by pulling the auricle outward and backward and direct the stream, under good illumination, between the foreign body and the wall of the canal, an ordinary kidney-shaped basin being held beneath the ear to collect the return stream, which will usually bring with it the impaction. Under no circumstances should the syringe be used with force, as much damage may be caused to the membrana tympani, as well as vertigo and faintness, by its use in unskilful hands. It is well, furthermore, to frequently examine the ear while syringing, in order to avoid this accident.

It may be advisable or necessary to remove the impaction, or part of the same, by the use of various instruments. These, however, should not be employed except in the hands of an expert. When absolutely necessary that the wax should be removed immediately, a few drops of hydrogen peroxide can be instilled into the ear and allowed to remain

about fifteen minutes, when the plug will probably be sufficiently loosened to permit of its removal. Hydrogen peroxide should never be used, however, in those cases where an underlying chronic otorrhea may exist, for fear of forcing infection through a destroyed drumhead into the adjacent cavities. Many serious intracranial complications have occurred in this manner in an otherwise quiescent case; in other words, hydrogen peroxide should be used only when the diagnosis of impacted cerumen is assured.

After the ear has been syringed it should be thoroughly dried, and if the canal shows much irritation an application of yellow oxide of mercury ointment should be made to its surface, or boric acid powder, or equal parts of boric acid and zinc oxide insufflated into the canal. This should be followed, in winter, by placing a piece of cotton in the external auditory canal, to provide against the effects of atmospheric cold.

When the deafness has been caused by impacted wax, its removal will almost assuredly restore normal hearing. If, however, there is an existing middle-ear catarrh, the hearing will, in all probability, not be improved by removing the obstruction. Then, again, in old, chronic suppurative cases, what appears to be impacted cerumen is, in reality, a collection of dried pus, desquamated epithelium, and wax, which communicates directly with the tympanic cavity through an old perforation, acting as an artificial drumhead, thereby increasing the hearing power. Its removal, in such cases, will most assuredly result in a considerable loss of hearing. It is well, therefore, to be very guarded in giving a prognosis until the obstruction has been removed, thus permitting a thorough examination.

Foreign Bodies.—These may be classed as inanimate: (1) Those influenced by heat and moisture, as peas, beans, and other seeds; (2) those not influenced by heat and moisture, as pebbles, glass beads, shot, etc.; and animate: (3) various insects.

Foreign bodies are mostly found in children, who purposely place them in the ear, just as they frequently introduce similar articles into the nasal chambers. Those not influenced by heat and moisture may remain in the canal indefinitely without being harmful or producing symptoms, so long as they do not impinge on the drumhead. Those influenced by heat and moisture will frequently swell and produce symptoms similar to impacted wax. When they are pushed beyond the narrow part of the canal by attempts at their removal, or the canal becomes irritated and swollen from the same cause, they are difficult to remove.

Fleas, bugs, and other animate bodies cause distressing noises, with more or less pain, when in contact with the drumhead.

Deafness is a prominent symptom, as it is with impacted cerumen when the meatus is completely blocked. There may be also severe tinnitus aurium, and attacks of vertigo and coughing. The foreign body may cause an acute inflammation of the external meatus, and later on a purulent discharge, which will continue until the source of irritation is removed. Myringitis frequently develops as the result of the scratching

movements of animate bodies against the membrana tympani. These movements are also responsible for the intense tinnitus aurium and pain caused by the entrance of insects into the external auditory canal. It is seldom that foreign bodies in themselves cause serious complications, but rather the unskilful use of instruments and the absence of proper reflected light in attempting their removal that cause injury to the membrana tympani by pushing the foreign body through the drumhead into the middle ear, thereby inducing a suppuration which may later produce mastoid disease or even meningitis.

It is important that the ear should be properly examined, by means of good reflected light through the speculum, to determine not only the nature of the foreign body, but its position and size. In experienced hands most foreign bodies are best removed by the use of instruments, which are, however, extremely dangerous in the hands of those less skilled; consequently, the syringe is not only the safest but the most common appliance used for this purpose.

It is always an unwise procedure for the physician to syringe an ear for the removal of either wax or a foreign body solely on the statement of the patient that such a condition exists; in other words, a proper examination should be made before ever attempting to treat the ear.

If the foreign body is of a character influenced by heat and moisture, and is beyond the narrow part of the canal or situated anterior to the same and entirely filling the caliber of the canal, so that water cannot pass beyond it, the syringe (Fig. 79) should never be used without first making an attempt to relieve the local irritation, as well as to shrink the foreign body and reduce the swelling incident thereto by the instillation of alcohol drops. Additional contraindications to the use of the syringe are when the foreign body is so placed that the stream has a tendency to force it farther in, or where there is much swelling and inflammation, due to unskilful attempts at its removal. The syringe is to be used, therefore, when the foreign body is anterior and there is little or no swelling.

An attempt should never be made to remove an insect that is alive without first killing it by the instillation of a few drops of alcohol or other antiseptic solution, which will also serve the purpose of relieving the irritation. It will then be readily expelled by the use of the syringe. If the insect is large, like a cockroach, it may be firmly impacted, and as a rule can only be removed by instruments.

Foreign bodies recently introduced into the canal can frequently be removed by placing the head far over to the side and hitting it with the hand, much in the same manner in which the boy removes water from his ear after swimming.

Smooth and round substances can sometimes be removed by moistening the point of a camel's-hair brush with a solution of glue; this is placed against the foreign body and allowed to remain sufficiently long to dry, when traction will remove the same. If more or less serious symptoms develop, such as severe pain or meningeal irritation, the foreign body must be removed immediately, first placing the patient

under ether, it being necessary at times to detach the auricle for this purpose.

The best instrument for the removal of foreign bodies is the hook, shown in the accompanying illustration, which occupies a minimum of space (Fig. 83). It is introduced sideways by placing the hook flat against and parallel with the canal, then turning it toward the centre and engaging it in the foreign body, which is readily removed.

FIG. 83



Hook to remove foreign bodies.

INFLAMMATION OF THE EXTERNAL MEATUS.

Otitis Externa Circumspecta, or Furunculosis.—This condition occurs most frequently in adults, usually the result of staphylococcic infection, the organisms gaining access to the subcutaneous tissue through a hair follicle, ceruminous gland, or an abrasion due to trauma. It is also associated with diabetes, and develops from the excessive use of bromides or iodides. Recurrence of furuncle is quite common, due to auto-infection.

It must be remembered that as a result of furunculosis, due to infiltration of the soft tissues behind the mastoid process, the classical symptoms of mastoiditis frequently occur, making a definite diagnosis requisite, as the treatment must be governed accordingly.

The pain, which is often severe and lancinating or throbbing in character, may radiate over the side of the head or jaws, and is usually much worse at night. Severity of pain is governed somewhat by the location and depth of the boil, being worse when the boil is in the osseous canal. No alteration in the hearing is manifest unless there is complete obstruction of the external meatus, due to a coincident swelling. Not uncommonly two or more boils may be present at the same time, or a single furuncle may so obstruct the canal that an inspection of the deeper parts is impossible, on account of the intense pain produced by the introduction of the speculum. A single boil is usually located on the floor of the cartilaginous canal, just beyond the meatus. Within four days "pointing" develops, or the furuncle usually ruptures within this period, in the absence of more rational treatment.

With spontaneous rupture or incision, the pain is immediately relieved, but may recur within a few days, due to the development of additional boils, unless energetically treated. In neglected cases this process of auto-infection may continue indefinitely.

Some cases of furunculosis, as above stated, present symptoms of acute mastoiditis, and must be carefully differentiated. In the former a painful swelling is observed in the external canal, the membrana

tympani is intact, the hearing is but little, if any, impaired, the onset and course are rapid, and much pain is experienced in mastication and movements of the jaw. Swelling over the mastoid is more apt to develop when the boil is situated on the posterior canal, whereas infiltrated edema in front of the tragus will occur when the furuncle appears on the anterior canal. With incision and evacuation of the boil, the threatening mastoid symptoms will promptly subside.

The first object in treatment is the relief of pain, which must be followed by local remedies that inhibit the propagation of microbic life, as well as the adoption of appropriate measures for improvement of the general health. An old otorrhea or other exciting factor should be corrected. In the adoption of any line of treatment, it must be borne in mind that the microorganisms invade the subcutaneous tissue and are, therefore, not greatly influenced by the local measures usually prescribed. A preparation composed of 45 per cent. pure carbolic acid crystals and 55 per cent. chemically pure camphor (camphor-phenol) is the most useful remedy, in my experience, for the relief of pain; it frequently acts also as an abortive in the early stages. When applied to a furunculous condition of the external canal, it exerts the combined properties of an anodyne, antiseptic, and germicide. Heretofore remedial agents of sufficient strength to destroy the existing germ life would also act as an escharotic; the camphor in this combination deprives the concentrated carbolic solution of its otherwise irritant property unless applied for too long a time.

In the very early stage, when the inflammation is slight, a boil will often disappear by irrigating the canal with a pint of hot boric acid solution every two or three hours, the ear to be well dried after each treatment; or the camphor-phenol may be applied to the boil and adjacent structures, this to be followed by the use of dry heat, by means of the hot-water bag or hot-salt bag. Bloodletting by means of the artificial or natural leech, in front of the tragus, may also be employed at this stage of the disease (Fig. 80). Cocaine, morphine, and similar preparations used as local anesthetics are useless, and are only mentioned here with a view of discouraging their rather popular use. The frequent instillation of a hot solution of biniodide of mercury in absolute alcohol (1 to 2000) gives relief in some incipient cases, while others are benefited by the application of a 1 per cent. formalin solution. Mild pressure, to promote absorption, by means of a cotton tampon slightly larger in caliber than the external canal, moistened with camphor-phenol solution and introduced just beyond the boil, is our best means of relieving the pain or aborting a furuncle in the early stages. This can be renewed every twenty-four hours for two or three days, the canal being wiped out with absolute alcohol before each re-introduction. Any remaining irritation of the canal will quickly subside under the influence of applications of yellow oxide of mercury ointment, first cleansing with alcohol, as above stated.

When the above measures fail, which may happen in a case of frank furunculosis, our only efficient means of treatment is free incision and

thorough evacuation by means of curettage. To prevent auto-infection and consequent redevelopment, the same treatment should be instituted when the boil has spontaneously ruptured and the opening is not sufficiently large to provide for good drainage and proper after-treatment.

Although a fair amount of local anesthesia can be obtained by the introduction of a camphor-phenol tampon, which must remain in the canal for twenty minutes, it is best, in the vast majority of cases, to place the patient under the influence of general anesthesia before resorting to surgical interference. The incision and curettage are quickly performed under the influence of nitrous-oxide gas, though ether would be used in extremely nervous patients (Figs. 84 and 85).

FIG. 84



Furuncle knife.

FIG. 85



Curette.

After the operation has been performed, a camphor-phenol tampon should be introduced into the canal. This will provide the necessary antiseptic and prevent subsequent suffering. This dressing can be renewed in twenty-four hours. The after-treatment consists in cleansing the canal with alcohol and the application of yellow oxide of mercury ointment above mentioned.

Should the patient be unable to continue under the physician's care, and there is no middle-ear disease, he should be directed to syringe the ear with warm mercuric bichloride (1 to 3000) each day for some time, this to be followed by filling the ear with a warm saturated solution of boric acid in alcohol, to remain in the ear for three minutes, when the ear should be thoroughly dried.

Many patients suffering from furunculosis are greatly debilitated and anemic. The underlying cause should be discovered, if possible, and prescribed for accordingly, not forgetting the possibility of diabetes, even in its incipency, as a frequent etiological factor. As a routine measure, calcium sulphide has been prescribed for years, but in my opinion it is absolutely worthless, both as a preventive and curative agent. The administration of liquor potassii arsenitis is very serviceable, acting almost as a specific in some cases of recurrent furuncle.

The recent introduction of vaccine therapy into medicine furnishes a valuable adjunct to the treatment of recurrent furunculosis. For this purpose an autogenous vaccine may be used, but a stock staphylococcus vaccine is equally efficacious. (See Vol. I.)

Otitis Externa Diffusa.—Diffuse inflammation of the external auditory canal is produced by the same etiological conditions as the circumscribed variety, which it may cause or may accompany, especially if the latter is neglected. In the diffuse variety, however, the organism found is usually the streptococcus, alone or with other microbes, while the circumscribed is due to the staphylococcus. It usually involves the whole surface, but may be confined to the osseous portion and external surface of the membrana tympani. A fruitful cause is the pernicious habit of dropping sweet oil and other germ-producing fluids into the ear. Scratching the canal with hairpins or other instruments is also responsible for the development of many cases, as are also various skin eruptions, such as eczema.

Much depends upon the extent and severity of the disease. In some instances the painful sensations are very slight, being nothing more than severe itching, accompanied by a feeling of heat and fulness. In others, especially when the deep canal and drumhead are involved, severe, deep-seated pain, radiating over the side of the head and jaw, is experienced. Pressure on the tragus, pulling upon the auricle, and movements of the jaw increase the suffering. As in furunculosis, impairment of hearing is governed by the amount of swelling of the walls of the canal. In addition, the membrana tympani is frequently involved in this disease, and the middle ear may also participate in the inflammatory process, in which event deafness may be pronounced. In such cases the pain is intense, and so also is the subjective tinnitus aurium.

The external meatus may be so swollen that inspection of the deep auditory canal is impossible, and the auricle may also be involved. When an examination is possible, the congestion of the osseous canal and drumhead is so marked and uniform that it is frequently most difficult to determine where the former ends and the latter begins. Very quickly extensive desquamation of the epithelium begins, which is followed by a serous exudate. This in turn becomes purulent, and may be profuse. In the later stages the external canal and drumhead are frequently covered with granulations, which disappear, however, under appropriate treatment, the tympanic membrane and canal gradually resuming their normal state. In chronic cases with considerable discharge (especially if the membrane has become perforated from without inward) much difficulty will be experienced in making a differential diagnosis from chronic purulent otitis media. Caries and necrosis are sometimes encountered in the severe forms of this disease.

In the absence of extensive inflammation and severe pain, simple acute cases will usually recover through the frequent instillation of a saturated aqueous solution of boric acid, which should remain in the ear five minutes; or the canal can be irrigated with a warm 1 per cent. lysol solution two or three times daily. Although syringing is very soothing and beneficial, force should never be used in its application, and following it the ear must always be dried and then *dusted* with boric acid powder, the object being to keep the canal as dry as possible. Syringing should be discontinued just as soon as the improvement will warrant

it. When the inflammation is marked and the pain troublesome, blood-letting in front of the tragus by means of the artificial or natural leech is helpful. At times it is necessary to use hydrogen peroxide before the scales can be detached. This should not be employed, however, in acute cases where there is perforation of the membrana tympani. In the more persistent forms, without excessive narrowing of the canal, the application of a strong solution of silver nitrate (40 to 60 grains to the ounce) is very beneficial. This should be followed by a saturated solution of potassium iodide to prevent discoloration.

Granulations can be removed by alcohol drops, either pure or diluted one-half with glycerin; when they arise from exposed bone and are obstinate, the curette or sharp spoon should be used, or they may be destroyed by silver nitrate. When the swelling is excessive and the consequent narrowing of the canal becomes marked, multiple incisions through the periosteum should be made; the canal should then be treated in accordance with the suggestions given above. Here, too, the vaccine treatment may be resorted to in obstinate cases.

As in furunculosis, the general health should receive proper care. Should the middle ear become involved in a suppurative process, the case must be treated the same as a chronic suppurative otitis media.

Otomycosis or Parasitic Inflammation of the External Auditory Canal.—This disease occurs mostly in the poorer classes, or those who reside in badly ventilated, damp houses. The growth of the fungus is favored by dampness, and it is consequently found among those who have acquired the vicious habit of instilling various drops, such as oily solutions or glycerin, into the ear. The fungus will not thrive where cerumen exists, nor in the presence of an active otorrhea, but is usually superinduced by some other condition, such as eczema of the external auditory canal. In my experience it is most prevalent among adult Russians living in poor hygienic surroundings, and consequently is noted mostly in the dispensary service of our large hospitals. There are, of course, exceptions to this rule.

The two most common varieties are the *Aspergillus flavus* and the *Aspergillus niger*, the latter predominating. In the former the accumulated mass of exfoliated epidermis is sprinkled with mycelia, giving it a yellowish color, while in the niger variety the desquamated epithelium is covered with dark or blackish spots.

Many patients complain only of an irritation or obstruction within the external auditory canal. In the more serious type, however, the pain is quite severe, owing to the diffuse inflammation present. The external auditory canal and membrana tympani show signs of marked inflammation and swelling in the more pronounced cases, whereas in the milder ones the redness is correspondingly slight. The canal is covered with a membrane (desquamated epithelium) which may be dotted with yellowish or blackish spots. On removing this accumulation, the canal frequently bleeds, owing to the erosion beneath. In some cases where the coloring matter is not pronounced, it may be necessary, in order to arrive at a definite diagnosis, to examine the membrane under the

microscope, which will reveal the presence of spores and mycelia. In the ordinary case, however, the diagnosis is easily made, as the appearance of the exfoliation is quite characteristic.

The two chief objects in the line of treatment are to remove the epidermis and to keep the canal as dry as possible.* In other words, after syringing, the canal should be dried and antiseptitized either by insufflating boric acid powder or equal parts of boric acid and zinc oxide. The fungus requires slight moisture for its growth, but, as stated above, it will not thrive either in the normal dryness of the canal or in the presence of an active suppuration. The epithelium is best removed by syringing with a warm normal salt or boric acid solution. If the scales adhere to the canal, it may be necessary to use forceps for their removal, after which the powder above mentioned should be insufflated into the canal, care being taken only to *dust* the surface and avoid introducing any large quantity into the meatus.

If the patient is unable to be treated daily for a short time, warm alcohol saturated with boric acid can be instilled into the ear three or four times a day by the patient, care being taken to dry the ear following each application. In case alcohol acts somewhat as an irritant, it may be best to use the biniodide of mercury (1 to 2000) in the same manner. The average case will improve better by varying these solutions. As the patient improves, it is best to discontinue all syringing, the ear to be wiped out with an antiseptic solution by the physician, after which either one of the powders above mentioned should be insufflated.

There is a constant tendency to resist medication and also to recurrence of the disease after the patient is apparently well. The case, therefore, must be kept under observation for a considerable time.

DISEASES OF THE MEMBRANA TYMPANI.

Wounds and Injuries.—Injuries to the drumhead are usually accidental and result from the introduction of such articles as hairpins, toothpicks, etc., or the unskilful attempt to remove a foreign body. Concussion from an explosion, blows on the ear, or the too forcible use of Sieglé's speculum, are not only fruitful causes of injury to the membrana tympani, but frequently result in lasting deafness. due to traumatism of the labyrinth. Forceful inflation of air through the Eustachian tube by means of Politzer's method or other apparatus may also rupture the drumhead, in such accidents, however, the membrane has previously become atrophied, and this is also true when a rupture results from the use of Sieglé's speculum. Fractures of the base of the skull, or other severe injuries of the cranial bones, cause rupture of the membrana tympani and the resultant familiar hemorrhage from the ear.

Immediately following a traumatic perforation of the membrana tympani, an intense explosive sound is experienced; pain, giddiness, and faintness follow immediately, their severity depending upon the nature and extent of the injury. When resulting from concussion that has

seriously impaired the function of the labyrinth, the deafness will be very marked, or may be complete and permanent if the function of the labyrinth has been destroyed. In the absence of concussion, traumatic perforation causes very little impairment of hearing. Permanent impairment, or even loss of hearing, may follow severe concussion, such as results from boxing the ears or loud explosions. In labyrinthine involvement bone conduction will be diminished or lost, depending on whether the function is impaired or destroyed. In severe injuries suppuration is not uncommon; it is especially prone to occur when meddlesome treatment is instituted.

The perforation may involve any part of the membrana tympani. The edge of the wound is covered with blood clots, while the adjacent membrane is more or less congested. The remaining portion is usually normal in appearance. From a medico-legal viewpoint the case must be seen within two or three days. Otherwise the resultant inflammatory changes would so alter the clinical picture that a definite diagnosis of trauma might be impossible.

In simple traumatic rupture it is of the utmost importance that the use of the syringe and all drops should be strictly avoided. The patient should be kept quiet, or, better, put to bed, restricted to soft diet, and a plug of sterile wool placed in the external canal, over which a dressing and bandage should be applied. This is especially indicated when the injury is accompanied by faintness, giddiness, and tinnitus aurium. If in addition to the above symptoms the pain is continuous, bloodletting in front of the tragus is indicated. When suppuration supervenes, which unfortunately is of frequent occurrence, the same treatment should be followed as is outlined for acute suppurative otitis media.

In internal ear or labyrinthine deafness the same rule of restricted diet and rest in bed should be enforced. Although I am opposed to the indiscriminate use of poultices and blisters in diseases of the ear, it would seem that a blister over the mastoid process is of service in the presence of persistent labyrinthine symptoms due to trauma. Strychnine is also indicated after the acute symptoms subside. Some cases will improve under the administration of the iodides, while others are benefited by the application of the constant current. The hypodermic injection of pilocarpin is serviceable in certain obstinate cases. In severe injury, where the function of the internal ear is destroyed, the deafness will remain permanent regardless of any treatment adopted.

Acute and Chronic Myringitis.—It is extremely doubtful whether primary myringitis, *per se*, occurs. However, some border-line cases are observed that indicate that the disease is occasionally met, but even in such instances it is impossible to say whether or not it is secondary, by continuity, to a process which has had its origin either in the tympanic cavity or the external canal. If this ailment occurs as a separate disease, the chief etiological factors would seem to be exposure to high winds, especially following bathing, injury from scratching the ear, and influenza.

The stinging pain is usually moderate and neuralgic in character;

there is very little, if any, disturbance of hearing, which must be the distinguishing diagnostic symptom between a primary inflammation of the drumhead and that secondary to middle or external ear disease. Marked injection of the vessels along the malleus is observed in the early stage; as the disease involves the entire membrana tympani, the landmarks are obliterated and the dermal layer becomes macerated and peels off. As a rule, these cases recover quickly. If they run a chronic course, more or less suppuration will be observed, as well as the formation of granulations, in which event they should be treated the same as diffuse inflammation of the external canal.

Mild cases will recover by dusting the surface with fine boric acid powder, or a warm saturated solution of boric acid can be dropped into the ear. The canal should then be dried and the ear protected by placing a plug of sterile cotton in the meatus. Should pain continue, it will be relieved by instilling a few drops of warm camphor-phenol into the ear. Warm, dry heat is beneficial in the early stage, as is also bloodletting in front of the tragus. In the chronic form a solution of zinc sulphate or copper sulphate (grains vi to the ounce) should be warmed and dropped into the ear. Granulations can be destroyed by either silver nitrate or chromic acid fused on a probe, care being taken to touch only the granulations.

DISEASES OF THE MIDDLE EAR.

Although clinically acute catarrhal otitis media and acute suppuration of the middle ear are separable, and really designate two distinct phases of the disease, they cannot always, from a pathological viewpoint, be satisfactorily differentiated; in other words, it is frequently impossible to determine where the former ends and the latter begins, because the first stage of an acute tympanic suppuration frequently has its origin in a primary acute catarrhal otitis media. Ordinarily, however, the catarrhal process runs a slow and irregular course, without pronounced symptoms, shows a persistent tendency to resist treatment, and is subject to frequent recessions; whereas, the acute suppurative type usually occurs suddenly, runs a rapid course, with marked suffering and high temperature, and under prompt care usually ends in recovery, without any special predisposition to relapse. In the absence of timely and proper care, however, this disease becomes the most dangerous, and therefore the most important, in all otology. The weight of this statement will be better appreciated when we grasp the fact that practically all serious ear affections and their complications, such as diseases of the mastoid process, sinus thrombosis, meningitis, labyrinthitis, and others, arise from an inflammatory process within the tympanic cavity. I wish, therefore, to emphasize the statement that this seemingly simple process of the middle ear will yield to *prompt* treatment in the vast majority of cases, but is replete with danger through the complications above enumerated, in the face of neglect or procrastination. The etiology of both the catarrhal and suppurative forms of otitis media is

identical; the symptoms, both objective and subjective, are likewise similar, varying only in degree, up to the point of perforation. In the first instance it is catarrhal, in the second purulent, while later the condition assumes the character of an acute or chronic suppurative otitis media, with all its attendant dangers. It is manifest, therefore, that our chief object in the line of treatment is the arrest or modification of the acute disease in its incipiency. Exceptional cases, especially those complicating the exanthemata, influenza, and pneumonia, present such severe primary symptoms that they are credited with being purulent from their very inception, and here an early incision of the membrana tympani for evacuation of the pus is indicated. From the above it will be seen that the initial disease is virtually the same in both instances, the chief distinction being one of degree instead of kind. In other words, if the symptoms, however painful or threatening, subside without perforation, the case is usually regarded as one of non-purulent inflammation; conversely, if the virulence of the infective organisms has been such as to cause necrosis and maceration of the tympanic mucosa, with consequent perforation and discharge, the case is then regarded as one of purulent inflammation (acute suppurative otitis media).

Acute Catarrhal Otitis Media (*Otitis Media Acuta Catarrhalis*).—The most frequent cause of acute catarrhal otitis media is some abnormal condition of the nasopharynx, especially the condition popularly known as “cold in the head,” the infection involving first the Eustachian tube, and, by continuity, the middle ear. Continued exposure to wet or cold is another contributing cause, as well as the presence of adenoid growths and enlarged tonsils, and in children the process of dentition. Some additional causative factors that are especially prone to induce a suppurative otitis media are the various exanthemata (scarlet fever, measles, and diphtheria), and also pneumonia, bronchitis, typhoid fever, tuberculosis, syphilis, and meningitis. Another fruitful cause is the habit of using the nasal douche or snuffing up various solutions into the nostrils for the relief of some supposed nasal affection. The mode of involving the middle ear in such cases is by driving the fluid from the nasopharynx into the Eustachian tube, and from there to the ear, by the force exerted in blowing the nose. In order to avoid this danger patients should be instructed always to leave one nostril open when blowing the nose. Many of these cases develop as a result of sea bathing, the salt water entering the Eustachian tube. Its effect on the normal ear is practically nil, so far as the entrance of the water into the external auditory canal is concerned, when compared with the bad results that so frequently follow forced blowing of the nose in an effort to relieve the nasal chambers of any fluid.

In the average mild case there may be only a sensation of fulness and a slight dull pain, or the pain may be sharp and stinging in character, or even quite severe, and is especially marked at night. The patient complains of pain on opening the mouth, mastication, and on pressure over the tragus just below the lobe. Sometimes the pain shoots up the side of the head and into the teeth. The constitutional disturbance in

adults is very slight, whereas in children there may be high fever with delirium, and certain muscular twitchings that simulate meningitis. In the more severe cases the pain is very marked and, as in the acute suppurative form, is governed largely by the amount of pressure exerted on the drumhead and the delicate mucous membrane; in other words, the greater the pressure, due to the accumulating fluid, the more intense the pain. It not infrequently happens that the localizing symptoms are so uncertain, the pain being complained of in various parts of the head, that the attending physician is misled as to the proper diagnosis. It is well, therefore, that the ear should be examined in all questionable cases, especially in children, as this will frequently clear up a doubtful diagnosis.

Owing to the swelling consequent upon inflammation of the Eustachian tube, ventilation of the tympanic cavity is interfered with and the drumhead becomes considerably retracted, due to absorption of the air; or if the case progresses, the membrana tympani eventually is pushed outward or bulges, due to the accumulation of fluid in the tympanic cavity. In either event there is considerable loss of hearing, as well as the presence of various subjective noises, with possibly vertigo, due likewise to pressure exerted either by the retracted drum or the accumulation of fluid. Loss of hearing is sometimes very marked in apparently mild cases, and the subjective noises most pronounced, caused, no doubt, by the involvement of the oval and round windows by the inflammation and consequent exudation.

On account of the existence of some pathological state of the nasopharynx, more especially adenoids and tonsils, children have frequent attacks of catarrhal otitis media, in which they suffer from pain at night and are apparently well during the day; this is known as "earache in children." Frequent attacks of this character are very apt to lead to certain changes in the drumhead and adhesions between the same and the tympanic wall, resulting later in life in a progressive catarrhal deafness. A correction of the existing cause in childhood will result in a great diminution in the number suffering from impaired hearing in after-life.

In mild cases the congestion of the drumhead is slight and may be confined to Shrapnell's membrane and running down the long handle of the malleus. The osseous canal is usually not involved in these cases. In the more severe types the entire membrana tympani is inflamed and swollen, the landmarks eventually becoming obliterated. Because of a similar edema of the osseous canal, it is sometimes difficult, in advanced cases, to determine where the canal ends and the drumhead begins. In some cases there will be bulging and rupture of the drumhead early in the disease, while in others (and these are probably the more serious form of the trouble) it will be impossible to note any bulging of the drumhead on account of the extreme swelling of the adjacent osseous canal. There is apt to be delayed perforation in cases of this type. As resolution begins the congestion gradually subsides, the membrana tympani slowly assuming its normal appearance. It is altogether likely that the mastoid cells are more or less involved in all cases of acute

middle-ear disease. This applies equally to the catarrhal and the suppurative forms, the difference being that in the former resolution is almost invariably met with, while in the latter the tendency to actual mastoid suppuration is very great.

Tubal Catarrh.—As above stated, the great majority of all acute middle-ear diseases have their origin in some pathological condition of the nasopharynx, the Eustachian tube first becoming involved, by continuity, and this in turn implicating the tympanic cavity. It will be seen, therefore, that the tube almost necessarily is first affected, and the tympanum and accessory cavities later, by continuity. In the very early stage of this process we have a condition frequently called tubal catarrh, which signifies that the disease has not yet reached the tympanic cavity, and indeed may for a time be confined to the lumen of the tube, but unless prompt treatment is instituted, will sooner or later involve the tympanic cavity. Cases of this character (tubal catarrh) produce many of the symptoms given under catarrhal otitis media, minus the pain, and are very amenable to the treatment given below. A similar condition may also prevail in a chronic catarrhal otitis media; the pathological changes here, however, are those incident to this disease.

From the fact that the great majority of cases of catarrhal otitis media are found in children, caused by the presence of nasopharyngeal disease or obstruction, it is manifest that our first duty in the line of treatment is the correction, in so far as is expedient, of all such causative factors. It is not possible to have a normal function of the organ of hearing in the absence of free nasal respiration, as proper ventilation of the tympanic cavity is dependent upon this important physiological process. This includes, especially in children, the removal of diseased tonsils and adenoid vegetations. In some cases, after removal of these growths, the hearing does not improve satisfactorily, which may be due to adhesions around Rosenmüller's fossa. This condition should be examined for and corrected at the time of operation.

During the first stage (hyperemia and congestion) the patient should be kept quiet and the bowels opened by the use of calomel and the administration of tincture of aconite in small, repeated doses. Blood-letting in front of the tragus by means of the artificial (Fig. 80) or natural leech is of great service, or where the attack is mild the simple instillation of warm drops or irrigation with a hot normal salt or boric acid solution is all that is required to obtain relief. These drops should be allowed to remain in the ear for three or four minutes, and can be repeated if necessary. Dry heat by means of the salt bag or hot-water bottle is also efficient in these mild cases. A preparation of some merit is one composed of equal parts of tincture of opium and tincture of belladonna, which should also be heated and dropped into the ear and allowed to remain a few minutes. It must be remembered that the benefit to be derived from any local application is the heat it imparts, rather than the efficiency of any purely medicinal property.

As heretofore stated, the only drug that seems to have an anesthetic effect on the skin surface (and it should be kept in mind that the external

layer of the drumhead is modified skin) is carbolic acid, and the preparation known as camphor-phenol (55 per cent. chemically pure camphor and 45 per cent. pure carbolic acid) will therefore be found efficient in some of these mild cases.

Astringent gargles or any other line of treatment that may be indicated for the correction of any nasopharyngeal condition should receive proper attention. Patients subject to repeated "colds" will receive much benefit by leading an out-of-door life, sleeping in well-ventilated apartments, and from daily sponging of the chest and neck with cold water.

After the acute symptoms have subsided, inflation by means of Politzer's method is beneficial, not only in opening the Eustachian tube, but also in freeing the middle ear of any fluid and restoring the membrana tympani to its normal position. This can be repeated three or four times, at intervals of two or three days. In case the disease progresses to the stage of suppuration, it then becomes an acute suppurative otitis media, for the treatment of which see under that heading.

Acute Suppurative Otitis Media (*Otitis Media Purulenta Acuta*).—Acute suppurative otitis media is an advanced stage of the catarrhal form, with the difference that the symptoms are of greater intensity and are quickly followed by spontaneous perforation of the membrana tympani in case the patient is not seen sufficiently early to provide for the evacuation of pus by means of a prompt incision of the drumhead. This latter procedure is always advisable. The cases in which complications develop are those where this early, well-recognized treatment is neglected. In other words, the best means at our command to prevent mastoid and intracranial complications is an early and free incision of the membrana tympani. This is true even in those cases of catarrhal otitis media where the symptoms are severe, it being much wiser to err on the side of conservatism and incise the drumhead early, than to run the risk of having complications develop through delay. It is more than probable that the mucosa lining the mastoid cells participates in the inflammatory process to a greater or less degree in practically all acute cases of suppurative otitis media. In some cases the labyrinth also is undoubtedly involved. As in the catarrhal form of disease, the discharge is serous or mucopurulent, rapidly becoming wholly purulent. It is very profuse in some cases and decidedly scanty in others. The percentage of mastoid involvement is about equal in either case. Many of these purulent cases complicating tuberculosis and pneumonia will develop with a minimum of suffering, even to the point of spontaneous rupture of the membrana tympani. There is a special predilection to mastoid and other complications in those cases developing in connection with the exanthemata, pneumonia, and influenza. In the latter disease the discharge is serosanguineous or even decidedly bloody. The symptoms are very active, the pain and suffering usually being quite severe. These cases occur so frequently that the term "influenza otitis" is a well-recognized characterization of this lesion.

The etiology of acute purulent otitis media is the same as that of acute

catarrhal otitis media. The majority of cases in the severe type of the disease, however, arise in connection with the exanthematous diseases, influenza, and colds in the head. In my own experience measles is responsible for the greatest number of purulent diseases of the middle ear, as well as for the greatest number of complications arising therefrom, especially mastoid disease. The next most frequent causative factor, in my experience, is influenza. This disease also follows injuries, operations upon the drumhead, and the improper use of instruments for the removal of foreign bodies, as well as operations within the nasal chambers and the removal of tonsils and adenoids. Sea bathing is another active cause, the salt water, no doubt, entering the middle ear through the tube from the force exerted by the patient in blowing the nose.

It is quite possible to have an acute suppurative otitis media without perforation of the drumhead. This could only occur, probably, in young children whose Eustachian tubes are relatively much larger than in the adult and thereby provide for free evacuation of the pus.

The symptoms of acute suppurative otitis media are likewise similar to those of the catarrhal form, but are much more severe, the pain at times being not only intense but continuous, radiating over the side of the head and into the teeth. In children, delirium and high fever are not uncommon, and these, together with muscular twitching which is present, form a picture simulating meningitis. Usually there is more or less tenderness over the tip of the mastoid, and pain is produced by movements of the jaw and auricle, or by pressure on the tragus. On account of the inflammatory process within the labyrinth, tinnitus aurium and vertigo are frequently present. The hearing is more or less impaired, and in some cases complicated with considerable labyrinthine involvement may even be temporarily lost. As a rule, the disease is unilateral, but is frequently bilateral.

In the absence of proper care, spontaneous rupture of the membrana tympani usually takes place about the fourth day, although it may occur within twenty-four hours, depending largely on the virulency of the infection and the destructive process which it sets up. This is especially true in the presence of the infectious fevers and influenza. In other cases perforation may be delayed for a week or more. The perforation is usually recognized after first cleansing the canal and observing the pus escaping through the opening, or, more especially, observing the pulsation, or the fluid can be forced through the perforation by means of mild inflation or the use of Sieglé's speculum. With the evacuation of pus, whether by means of spontaneous rupture or by incision, the patient experiences immediate relief, with an abatement of the fever and other head symptoms. If the above-mentioned improvement does not occur along with evacuation of the pus, we should suspect mastoid or even more serious complications.

The discharge, at first serous or mucopurulent, gradually becomes thicker and decidedly purulent for several days, and then may become a yellowish green. In the absence of complications the discharge grows

thinner and gradually diminishes in quantity, usually ceasing about the fifth week. The membrana tympani shows signs of marked congestion, which is rapidly followed by a bluish-red color, with much swelling and obliteration of the landmarks, depending upon the intensity and extent of the inflammation. In the more severe cases the bony auditory canal becomes so markedly congested that it is most difficult to distinguish where the canal ends and the membrana tympani begins. During the stage of exfoliation the drumhead is so red and glistening that it frequently resembles a polypoid growth. Just before perforation the drumhead bulges, more frequently the posterior half, due to the collection and pressure of the fluid within the tympanic cavity. As a rule, in influenza cases the symptoms are all greatly intensified, and spontaneous perforation occurs early; this is true also of measles.

In the absence of treatment there is apt to be permanent disturbance of hearing, due to the ossicular chain being bound down by adhesions to the tympanic wall, and also caries of the adjacent osseous structure, which favors the various complications above enumerated.

When the discharge is persistent, a resort to autogenous vaccines should not be overlooked, as this may relieve a condition which, if allowed to progress, would result in permanent deafness or require surgical treatment.

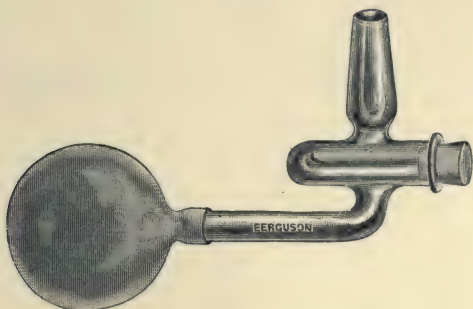
The treatment of the early stage of acute suppurative otitis media is similar to that of the acute catarrhal form, the chief point in either being *never* to allow the drumhead to rupture spontaneously, as it is through early incision and evacuation of pus that we are able not only to cure the acute disease, but more especially to prevent serious complications. Our chief object, then, is the relief of pain and the promotion of free drainage, which can be accomplished only through spontaneous rupture or early incision. Unfortunately, in the great majority of cases spontaneous perforation has already occurred when the patient seeks relief, and this largely accounts for the numerous complications.

A continuation of pain and high fever may be due to insufficient drainage, notwithstanding spontaneous rupture has occurred, in which event the opening should be promptly enlarged, or if the drumhead is still intact and bulging is observed, it should be freely incised. In virulent cases, especially those suffering severely, accompanied by pyrexia, it is best to incise the drumhead early, even though there is no bulging. This is especially true when the aural lesion complicates one of the exanthemata, influenza, or pneumonia.

The technique of *myringotomy* is as follows: After thoroughly cleansing the canal by irrigation with a bichloride solution (1 to 5000), sterilizing the auricle and adjacent parts, a small pledget of cotton saturated with a solution composed of equal parts of cocaine, menthol, and carbolic acid should be applied directly to the drumhead for about ten minutes. This in the great majority of cases will anesthetize the membrana tympani, making the incision practically painless. In many cases, however, especially in children, general anesthesia will be necessary.

The incision, made with a bistoury, is started at the most bulging or dependent portion of the drum and carried down to the lower border of the membrane, from which point it is curved and carried either anteriorly or posteriorly until it has formed one-fourth of a circle. This not only provides for good drainage, but insures the opening remaining patulous sufficiently long to admit of proper after-treatment. The fluid should be drawn out through this incision by means of an aspirator, a proceeding which has greatly lessened the necessity of subsequent mastoidectomy (Fig. 86). A strip of iodoform gauze is inserted deep into the canal to provide drainage, and is renewed in twenty-four hours if necessary.

FIG. 86



Aspirator.

The after-treatment consists in wiping out the canal with a mild antiseptic solution and then drying the same with a cotton-wrapped probe and dusting an impalpable powder, such as boric acid, or equal parts of boric acid and zinc oxide, on the walls of the canal. At subsequent treatments the progress of the patient will be materially enhanced by applying directly to the mucosa that lines the tympanic cavity, through the incision in the drumhead, a solution of silver nitrate, three to ten grains to the ounce, or zinc sulphate, copper sulphate, or lead acetate, eight grains each to the ounce of water, after which the ear can be dried and the powder insufflated as above mentioned. It must be borne in mind that the surface is to be merely dusted, as the introduction of much powder will impede drainage and favor the retention of pus. After the first twenty-four hours the ear may, if preferred, be gently irrigated with a mild antiseptic solution, such as boric acid; but in my experience the "dry method" of treatment, as detailed above, has given the most satisfactory results and is certainly the more efficient of the two, in experienced hands. Internally, the administration of hexamethylenamine (urotropine or uritone) is probably of some service, as it has been found in the discharge of an acute suppurative otitis media when so administered.

As above stated, if the pain and fever continue after free drainage has been established, it is reasonable to suspect mastoid complication

sufficiently advanced to virtually require operative interference. The patient should be kept in bed, on light diet, and freely purged, together with bloodletting in front of the tragus if seen early. With a view of preventing any further involvement of the mastoid process, an ice-bag may be applied directly over the mastoid process for from twelve to thirty-six hours continuously. It is inadvisable to mask the symptoms by the use of morphine or similar drugs, unless administered for the specific purpose of relieving pain pending surgical intervention.

After the subsidence of the acute symptoms either one of two methods of local treatment can be followed, namely, the wet or the dry method. The latter is recommended to all those who have the opportunity of seeing their patients frequently, whereas, the wet method of treatment is more applicable to those cases where the patients assume the greater part of the subsequent treatment. In some cases, however, the purulent discharge is so profuse that it is necessary to syringe the ear frequently for a few days, until the discharge materially lessens, before the dry method of treatment can be instituted.

The wet method consists in irrigating or syringing the ear (preferably the former) with a warm normal salt or boric acid solution, or still better, a 1 per cent. solution of lysol, this to be repeated two or three times a day at least, depending upon the amount of discharge, and gradually lessening as the condition improves. After each irrigation the ear should be dried as well as possible and the canal protected from cold and dust by placing a small piece of sterile cotton in the meatus. Force, either by irrigation or in the use of the syringe, should be strictly avoided. The bag containing the water should not be more than two feet above the ear, and the syringe should be used very gently.

FIG. 87



Applicator.

The dry method is instituted by cleansing the ear with absorbent cotton on an applicator, after which it is wiped out with an antiseptic solution, such as bichloride (1 to 3000) or a 1 per cent. lysol solution (Fig. 87). The ear should then be dried and boric acid powder, or equal parts of boric acid and zinc oxide, insufflated into the canal with a powder-blower, care being taken to introduce only sufficient powder to cover the canal, as a quantity might interfere with drainage. This should be repeated every day for a few days, the treatments being gradually lessened according to the progress of the case, and regulated more especially by the decrease in the amount of discharge. In those cases in which there is a tendency for the discharge to continue, an application made into the tympanic cavity, through the opening in the drumhead, of eight grains of copper sulphate or lead acetate, or ten grains of silver nitrate, to the ounce of water, will be found beneficial, the object being to use a minimum of fluid, thereby rendering the ear

as dry as possible. With this object in view, it is always well to use one of the powders above mentioned after each treatment.

Under certain conditions there is a tendency for the perforation in the drumhead to close prematurely, before the tympanic mucosa has had time to recover. In such a case it is not uncommon for the patient to suffer again from attacks of earache caused by further accumulation of fluid. The membrane thereupon should be freely incised again.

After the purulent discharge has subsided and the perforation in the membrana tympani has healed, the tympanic cavity should be inflated by Politzer's method or by use of the Eustachian catheter as a means of preventing adhesions between the drumhead and ossicles and the inner wall of the tympanic cavity. In some cases it seems advisable to use this inflation to rid the Eustachian tube and tympanic cavity of secretion before the actual subsidence of all inflammatory symptoms, though this practice is not always justifiable, the chief objection being that it favors mastoid involvement through the possibility of forcing some infectious material into the mastoid cavity.

Chronic Suppurative Otitis Media.—As above intimated, chronic suppurative inflammation of the ear is a continuation of the acute suppurative form, and is made possible usually through neglect or ineffective treatment of the former, and this in turn is due usually to insufficient drainage, or else the infection is so virulent that there is an early necrosis of the osseous structure. General causes that tend to bring about a chronic discharge are unsanitary surroundings, pneumonia, rickets, tuberculosis, syphilis, or otherwise impaired health, and also the presence of diseased adenoids and tonsils, or an abnormal condition of the nasopharynx which has not been corrected. Sometimes the membrana tympani is extensively destroyed, leaving the tympanic cavity exposed to various forms of infection, in which case the formation of granulation tissue and polypoid growths, as well as caries of the ossicles and osseous structure of the middle ear and mastoid, is favored. This disease is found more commonly among the poorer classes, on account of the indifference shown in treating the acute form of the disease.

In case the hearing remains normal in the healthy ear, patients very soon become accustomed to the loss of hearing in one ear, and in the absence of pain or other inconvenience the average patient seems to care but little about a running ear, especially when the discharge is slight. Some patients have had a more or less freely discharging ear extending over many years without causing any serious complication. The average case, however, suffers from time to time an acute exacerbation of the chronic otorrhea, caused by the retention of the discharge, usually in the attic, in which event there is a feeling of fulness in the head, together with some pain in the ear, which symptoms are relieved by the reappearance of the discharge. When it is remembered that the vast majority of all intracranial complications arising from suppurative aural disease have their origin in the chronic form, and more especially in this recurrent type, it behooves one to regard every case of otorrhea with more or less apprehension, notwithstanding the fact, as above stated, that some

patients are afflicted with the disease for a long period of years before a brain abscess or other intracranial lesion develops.

The character of the discharge is a matter of importance, particularly as an index to the site and extent of disease. A ropy, mucoid discharge indicates that the Eustachian tube is chiefly involved, due to the presence of nasopharyngeal disease. A copious, creamy discharge indicates the involvement of the mastoid cells, while a discharge less profuse, brownish or greenish yellow in color, and having a decidedly offensive odor points to extensive bony decay, involving frequently the tympanic attic and mastoid antrum. A bloody discharge shows the presence of extensive granulation tissue or polypoid growth. The presence of cholesteatomatous masses is always serious and usually calls for operative interference.

Vertigo and nystagmus point to a more or less extensive involvement of the labyrinth. I have seen numerous cases of sudden facial palsy and sinus thrombosis, as well as brain abscess, in which the ear, owing to the absence of active symptoms, had been entirely forgotten as the underlying pathogenic factor.

The perforation may occur in any part of the membrana tympani, and varies in size from a pinpoint to complete destruction of the membrane. In those cases resulting from scarlet fever and other infectious diseases there may be complete disappearance of the ossicles. The amount of hearing varies in different cases, some patients hearing quite well even though the drumhead and ossicles are destroyed, provided there is no fixation of the stapes in the fenestra ovalis. Such cases always hear better while the discharge is more or less active.

This condition varies so much in different cases as regards the extent of involvement that it is not possible to outline arbitrarily a routine treatment that is applicable to all patients. This applies both to the popular habit of always syringing, as well as to the more modern method of resorting to surgical treatment. Our object is to cure the discharge, and any and every means at our command should be employed to accomplish this end. If it can be done without surgical intervention, so much the better; if not, then surgery is our only available means of betterment. Here, again, the first step is to provide for free drainage, notwithstanding the fact that the drumhead and ossicles may be destroyed, as the discharge may have its origin in the attic or even in the mastoid antrum and cells. When the site of infection is confined to the Eustachian tube and tympanic cavity, conservative measures will usually suffice, whereas operative treatment is necessary when the seat of disease is beyond the reach of such measures.

Syringing with various antiseptic solutions is a popular line of treatment and is of much service, but should only be employed in combination with other methods of treatment. Care should always be taken in using the syringe that force is not employed, as vertigo and even collapse sometimes follow the forcible introduction of water into the tympanic cavity through the perforated drumhead.

After the ear has been cleansed, either by syringing with an antiseptic solution or by cotton on a cotton-carrier, it should be dried and *dusted*

with a powder composed of boric acid, or equal parts of boric acid and zinc oxide, in a powder-blower. Only a small quantity of powder need be used for this purpose. Powder in any quantity should not be used when the opening in the *membrana tympani* is small.

The instillation of drops is carried out by filling the canal with some concentrated astringent solution, and is frequently a valuable line of treatment, especially for patients to carry out themselves. When the discharge is profuse, it is best that the ear should be first syringed, then dried, and with the head resting on a table and the affected ear turned upward, fill the canal with the solution and allow it to remain four or five minutes, after which the ear should be again dried. The preparations giving the best results are eight grains of zinc sulphate, or copper sulphate, or lead acetate, to the ounce of water, any of which should be warmed before using. The effects of any preparation are rather quickly lost in suppurative disease of the ear. It is well, therefore, that these solutions, together with one composed of from 10 to 40 grains of silver nitrate to the ounce of water, should be used alternately. Granulation tissue that is not too extensive can be destroyed by the instillation of warm alcohol. In case the ear is sensitive, the alcohol can be diluted with glycerin, 50 per cent. each, gradually increasing the proportion of alcohol until the full strength is obtained. The ear should first be cleansed and the alcohol instilled in the manner above suggested. This should be repeated once or twice a day, gradually decreasing in frequency as the granulations disappear. In some cases it will be necessary to use the galvanocautery or chromic acid fused on a probe. Care must be taken to apply the chromic acid only to the tissue to be destroyed, and its use should be restricted to expert hands. The galvanocautery has the advantage of destroying only the tissue with which it comes in contact, whereas the limitations of destruction by chromic acid cannot always be definitely anticipated.

It is obviously necessary that all obstructions, such as excessive granulation tissue and polypoid growths, be removed before the site of suppuration can be reached, and at times this requires a resort to surgical means to accomplish. Polypoid growths are removed by the snare, and obstinate granulation tissue by the use of curettes and sharp spoons. Sometimes the disease involves principally the attic, and the site cannot be readily reached by the foregoing measures. The use of the above-mentioned preparations of zinc sulphate, copper sulphate, and lead acetate by means of the tympanic syringe (Fig. 88) is often serviceable. These solutions, as well as all others that enter the ear, should be heated before use. Before any surgical measure is advised, the autogenous vaccines may be tried, although in my hands the results from this line of treatment in chronic aural suppuration have not been all that could be desired.

In case all these measures fail to correct a chronic otorrhea, then the operation known as ossiculectomy, or removal of the ossicles, becomes necessary, and should, in the average case, or in the absence of urgent symptoms, be employed before operations on the mastoid are advised.

However, in a goodly number of these cases nothing short of a radical mastoid operation will effect a cure. It is never well, furthermore, to wait until the development of urgent symptoms before this operation is advised. Another point to be remembered is that patients can, in all probability, have a brain abscess for an indefinite time without producing symptoms, and, furthermore, that most of the intracranial lesions have their origin in a chronic suppurative otitis media. In order to prevent these complications, conservatism is best served, in many instances, by surgical interference when the more simple methods of treatment fail to arrest the disease. As I am restricted to the non-surgical treatment of diseases of the ear, the reader is referred to the volume on surgical treatment for a further consideration of this subject.

FIG. 88



Tympanic syringe.

Chronic Catarrhal Otitis Media.—I have purposely left the subject of this chapter for the last of the diseases involving the tympanic cavity, from the fact, as before stated, that the acute catarrhal is in many cases the first stage of the acute suppurative, which in turn is the first stage of the chronic suppurative disease, and although a chronic catarrhal otitis media is usually an advanced stage of the acute catarrhal form, yet it does present some few characteristic changes which eventually result in progressive deafness; in other words, a chronic catarrhal otitis media frequently results from repeated attacks of the acute catarrhal variety.

In one type of these cases there will be general thickening of the mucosa lining the tympanic cavity; in another the catarrhal condition chiefly involves the Eustachian tube, more or less obliterating its function, with consequent marked retraction of the tympanic membrane. In the latter case there is apt to be considerable adhesive tissue between the membrana tympani and the inner wall of the tympanum, to which the drumhead is firmly attached, and this in turn causes an ankylosis of the ossicles, due to their protracted immobility. As a rule, catarrhal conditions of the middle ear are curable in their early stages, but on account of this being a disease practically without symptoms, it usually is fairly well established before the patient is cognizant of its existence; in other words, by the time subjective symptoms present themselves, such as loss of hearing and tinnitus aurium, the disease is fairly well advanced. In one instance the drumhead becomes very thick, showing calcareous deposits, with more or less narrowing, or even permanent occlusion (stricture) of the Eustachian tube. In other cases, on account

of atrophy or shrinking of the tissues, the mucous membrane and membrana tympani become very thin and parchment-like in appearance. There is another condition, known as chronic dry catarrh, or otosclerosis, which, from a pathological viewpoint, deserves separate consideration.

Those individuals who are subject to frequent attacks of nasopharyngeal catarrh, or who from any other cause maintain a congestion of the mucous membrane of the upper respiratory tract, undoubtedly have a predisposition to this disease. This is true also of those who use alcohol and tobacco to excess, as well as of those whose occupation requires them to spend long hours in damp, poorly ventilated places. Chronic catarrhal otitis media seems to be an aural disease in which heredity plays a strong part. It is also a complication in both Bright's disease and syphilis. One ear may be deaf for quite a long time before the other one becomes involved. As a rule, however, when an impairment of hearing begins in the good ear, its progress is very rapid, the deafness soon becoming more marked than in the ear previously attacked. This is true also of the subjective noises. Notwithstanding how marked the deafness may be or how annoying the tinnitus aurium, which frequently is most distressing, these patients are scarcely ever wholly deaf in uncomplicated cases, they being able to hear through a trumpet or speaking tube. The noises at first may be intermittent and slight, but gradually become continuous and resemble a pulsating or hammering sound, the escape of steam, buzzing, or the high or low pitch of musical instruments. Vertigo is usually a symptom that occurs in the later stages of the disease, this also being slight at first, but frequently becoming so severe that the patients stagger and even have slight nausea. These symptoms are generally recognized as tympanic, in contradistinction to those commonly known as true Ménière's disease. If, however, they are the result of sudden hyperemia of the labyrinth, they may present all the phenomena of Ménière's symptom complex.

An effort should be made to relieve the tympanic cavity of any secretion and to render the Eustachian tube patulous, as well as to correct the position of the membrana tympani and ossicles, and as far as possible reestablish their function. Unfortunately, as above stated, the pathological changes in the majority of these cases are such as to make impossible the accomplishment of all these desirable ends. Our chief object, therefore, in instituting any line of treatment, in most instances, is not so much to correct these abnormalities as to stay the progress of the disease; that is, to enable the patient to retain what hearing he possesses and correct or modify the tinnitus aurium and vertigo. This much can be accomplished in many cases; in others, however, the disease will be progressive regardless of any line of treatment. It is of the utmost importance that the nose and nasopharynx should be rendered as nearly normal as possible. We must also look after the general bodily health of the patient, as well as apply treatment to the ears themselves. The following line of treatment will be necessarily non-operative, and the reader is referred to the volume on surgical treatment for that phase of the subject.

With a view of cleansing the tube and tympanic cavity of secretion, inflation by means of Politzer's method or the use of the catheter should be followed. Politzer's method of inflation is the one popularly used. However, in skilful hands it is usually better to use the catheter; in the use of either one great care must be exercised not to employ force, as much damage is frequently inflicted in this manner. For instance, in those atrophic cases where the drumhead is very much thinned, incident to such changes, it will rupture very readily under undue pressure. The catheter is used also as a means of introducing various medicaments through the tube into the tympanic cavity.

The prognosis is more favorable in those cases in which the power of hearing is improved after inflation. This will not be permanent, and usually lapses in a few days. Even though there is no improvement in hearing after inflation, it has the effect of relieving the feeling of fulness in the head and diminishing the tinnitus aurium. If after three or four treatments no improvement in either the hearing or tinnitus aurium is noted, this line of treatment should be discontinued. In favorable cases it may be repeated once or twice a week so long as the improvement continues, when it should be stopped or continued with much less frequency. The injection into the tympanic cavity, through the Eustachian catheter, of a 3 per cent. dionine solution, gradually increasing to an 8 per cent., as suggested by Randall, seems to be of benefit in some cases of the hypertrophic variety. However, I have seen a number of cases suffer from nausea, vomiting, and general malaise after the use of this drug. The oleate of zinc, as used by Neumann, has produced the best results in my hands. For this purpose, also, Politzer recommends the use of a 2 per cent. solution of pilocarpin, in the same manner. In syphilitic cases a 10 per cent. aqueous solution of potassium iodide is of service locally, although this must be supported by the internal administration of this drug, as well as mercury and hypodermic injections of pilocarpin in sufficient doses to produce free diaphoresis. A combination of mercury, iodides, and a third alterative, arsenic, which is very efficient, is liquor arseni et hydrargyri iodidi (Donovan's solution), given in the dosage of five to ten drops, well diluted with water, and with caution may be pushed even higher. It is obvious that any solution injected into the tympanic cavity should be sterile, as should also everything else entering into the operation, to avoid acute infection of the tympanic cavity. If these injections are beneficial, they can be used once in from three to seven days, the idea being that so long as improvement exists the treatment should continue, but when no further gain is noted it is best to suspend all treatment for a time and resume later on.

Massage of the eardrum and ossicles by means of Sieglé's pneumatic speculum (Fig. 78) is of considerable service in some cases. The bulb should be compressed before the aural piece is introduced tightly into the meatus, so that the first effect on releasing the pressure will be to pull the drumhead outward. This should be followed by quick compression and relaxation of the bulb for two or three minutes in each ear. Rarefaction should be used in atrophic cases, or where the drumhead is very

thin, or more especially in cases where the drumhead is retracted and improvement has been obtained by inflation.

An out-of-door life, with properly regulated exercise and bathing, together with the administration of alterative tonics, is indicated. I find much benefit from the administration of a preparation of iodine internally, and for this purpose use extensively a preparation called compound wine of iodine, which contains one-sixth of a grain each of iodine and bromine and one one-hundredth grain phosphorus to the dram, this to be given in half-dram or dram doses, three times a day, over a long period.

For temporary relief from tinnitus, the internal administration of the bromides is sometimes of service. Probably the most efficient form to prescribe in this condition is the dilute hydrobromic acid, beginning with ten-drop doses well diluted with water, three or four times a day, and increasing the dose one drop each day until twenty or thirty drops are reached.

Otosclerosis.—Otosclerosis is a form of chronic middle-ear disease characterized by progressive deafness, due to abnormal changes in the capsule of the labyrinth. There is complete fixation or ankylosis of the stapes to the margin of the fenestra ovalis. The condition differs from chronic catarrhal otitis media with adhesions on account of the absence of many of the symptoms of aural catarrh. The mucous membrane of the tympanic cavity becomes congested and is replaced later by a spongy, bony exudate (osteophorosis), especially the margins of the fenestra ovalis, this in turn causing ankylosis. This spongy bone may also be found in the cochlea, semicircular canals, and vestibule, and is plainly shown by microscopic examinations. If there is also sclerosis of the bone present, the fenestræ and labyrinth may be more or less completely filled with bony masses.

This disease is found mostly in young adults from twenty to thirty years of age, and when present in younger subjects is frequently associated with syphilis. Young, anemic women are, however, the most frequently afflicted in this manner, the disease very often occurring in these subjects during pregnancy, causing sudden and often permanent deafness about the time of parturition. Deafness or impairment of hearing, or tinnitus aurium after parturition, in anemic women or those otherwise in impaired health, should be looked upon as the result of a more or less advanced state of sclerosis. Generally speaking, those patients who suffer from hypertrophic conditions of the upper respiratory tract will have similar changes within the organ of hearing. This is also true in the atrophic variety of catarrh, and is associated with otosclerosis. Heredity seems also to be an important causative factor in this disease.

In the initial stage the tinnitus aurium may be slight and intermittent but gradually becomes continuous and very severe. Usually after many years of discomfort from the tinnitus aurium and gradually impaired hearing, the deafness becomes complete, and with this the tinnitus aurium usually ceases. Sometimes the noises continue persistently, notwith-

standing the deafness, and are much more distressing than the impaired hearing or actual deafness. A symptom of diagnostic importance is that the tinnitus aurium is referred to the head in otosclerosis, whereas the noises seem to emanate from the ears in chronic catarrhal otitis media.

The deafness and tinnitus aurium are persistently progressive, notwithstanding all efforts for their amelioration, and in this respect the condition differs from chronic catarrhal otitis media with adhesions, and also from the fact that it is not influenced by change of climate, dampness, etc. After a certain degree of deafness has been attained, the disease may remain stationary for a considerable length of time, or it may rapidly grow worse. One ear is usually affected first, and later both; as a rule, the second one involved progresses much more rapidly than the first. A notable feature of this disease is that the deafness and tinnitus aurium are usually much worse after fatigue, either mental or physical, and are consequently most distressing in nervous individuals. The changes in the membrana tympani are those incident to and characteristic of atrophy. The membrane is thin and the promontory is seen to shine through a pinkish-colored mucous membrane. The same atrophic changes are observed in the external auditory canal, which is dry, and the mucosa lining the nasopharynx and nose, which is also pale and thin, while the caliber of the Eustachian tube is correspondingly large, owing to atrophic changes. Bone conduction is lost through gradual involvement of the labyrinth, the high tones being first impaired.

This is the one disease in which great harm can be, and often is, done by meddling treatment. Local treatment is, as a rule, useless, and in many cases actually produces harmful results. Without arriving at a proper diagnosis, many of these patients are subjected to more or less violent inflation by Politzer's method. The tube, being abnormally patulous, owing to atrophic changes, admits the air with great force into the tympanic cavity, causing concussion of the labyrinth in the one case, or rupture of the unnaturally thin membrana tympani in the other. The rule is, therefore, that local treatment in this particular type of aural disease is inadvisable. However, something can be accomplished for the amelioration of symptoms by the internal administration of proper therapeutic measures, although it must be borne in mind that the prognosis is always bad, much depending upon the maintenance of good general health and the avoidance of mental and physical exhaustion. As many of these cases suffer from anemia, this condition should be properly treated. The deleterious effects of pregnancy and parturition in the early stages of this disease must always be borne in mind. Phosphorus, combined with strychnine, internally administered, is probably the most dependable remedy, especially in the form of glycerophosphates comp., which, together with proper hygienic surroundings and good, nutritious food, will be our best therapeutic measures.

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